FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 1313. (Vol. XXVI. No. 8.) **26th Year.** FEBRUARY 22, 1934 **Weekly, Price 6d. Post Free, 7½d. Abroad, 8d.**

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C.2

Telephone (2 lines), Holborn 3211 and 1884.

Telegrams: Truditur, Westcent, London.

Subscription Rates, Post Free.

United Kingdom	s.	d.	Other Countries	s.	d.
3 Months ..	8	3	3 Months ..	8	9
6 ,, ..	16	6	6 ,, ..	17	6
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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1934.
Feb. 23. British Gliding Association Annual General Meeting, at R.Ae.S.
Feb. 24. No. 10 Sqdn. R.A.F. Reunion Dinner.
Feb. 28. Air Command, Legion of Frontiersmen, General Meeting and Informal Supper, Barnett's Hotel, Craven Street, W.C.2.
Mar. 1. "Speed and the Economics of Air Transport," Lecture by Maj. F. M. Green before R.Ae.S.
Mar. 2. Norfolk and Norwich Ae.C. Annual Dinner and Dance, Arlington Rooms, Norwich.
Mar. 6. "Relation of the Molecular Structure of Fuels to Their Behaviour in Diesel Engines." Lecture by G. D. Boerlage before R.Ae.S.
Mar. 10. Lloyd's Register Annual Reunion Dinner, May Fair Hotel.
Mar. 15. "Some Developments in Aircraft Construction." Lecture by H. J. Pollard before R.Ae.S.
Mar. 21. "Some Problems of a Technical Service." Lecture by Wing Com. G. W. Williamson, before R.U.S.I.
Mar 24. Services Rugby: R.A.F. v. Army, at Twickenham.
Apr. 5. "Engines." Lecture by Capt. A. G. Forsyth before R.Ae.S.
Apr. 12. "Speed and the Future of Commercial Aircraft." Lecture by M. Louis Breguet before R.Ae.S.
Apr. 26. "Landing in Fog." Lecture by Dr. Rüd Stüssel before R.Ae.S.
Apr. 27-May 6. International Aero Show, Geneva.
May Wilbur Wright Memorial Lecture, before R.Ae.S.
May 17-June 2. Royal Tournament, Olympia.
May 21. Guild of Air Pilots Garden Party.
May 26. Heston Air Navigation Trials.
May 27. Deutsch de la Meurthe Cup.
June 3. London Aeroplane Club Garden Party, Hatfield.
June 23. Lancashire Ae.C. Air Display, Woodford.
June 30. Royal Air Force Display, Hendon.
July 13-14. King's Cup Race.

INDEX FOR VOL. XXV.

The 8-page Index for Vol. XXV of "Flight" and "The Aircraft Engineer," January to December, 1933 (with over 7024 references for "Flight" and 197 references for "The Aircraft Engineer"—7221 in all), is now ready and can be obtained from the Publishers, 36, Great Queen Street, Kingsway, W.C.2, price 1s. per copy (1s. 1d. post free).

EDITORIAL COMMENT

FIFTY-TWO squadrons for the Command Air Defence of Great Britain were reckoned the minimum in 1923. In 1934 that Command can only muster 42 squadrons. Our self-denying Ordinance has been a remarkable "gesture." There is no parallel to it in the world except the absence of armaments and defences on the border between the United States and Canada. Those two nations are alike in their pacific sentiments, and war between the United States and the British Empire is unthinkable. So is war between Great Britain and any of the three nations across the sea, France, Belgium and Holland. That fact has allowed us to take liberties with our defence preparations in the last 11 years, but it does not mean that it is any longer safe for us to neglect the cause of self-defence. Europe is not like the continent of North America. We British are as peace-loving as are the Canadians and Americans, and the French also are a peaceful, industrious nation. The ambitions of Louis XIV and Napoleon are as dead as those of Henry V. If Europe consisted only of the four nations we have mentioned there would be no need for any armaments.

On Guard!

Parts of Europe, however, are like an infernal machine with the clockwork insecurely braked. They may explode at any moment. The quarrel, if it comes to a head, will probably be no concern of ours, but we must be prepared to defend ourselves. Even the defence of neutrality calls for an efficient armed force. The guns of Holland were not entirely silent throughout the great war. As a Great Power

in a continent of many Powers, we must have strength behind our words, or those words will count for very little. If we cannot at the very least put up a good defence of our capital we shall be respected by none.

The probability is that most nations desire peace, but Soviet Russia is one which openly preaches to the young that they must prepare for the war on Capitalism, and that Great Britain is the chief exponent of the Capitalistic theory. At Geneva the Russian representative proposed complete universal disarmament. It is just as easy to propose complete disarmament as partial disarmament when one intends to go on unremittingly piling up one's own forces. Since that time Russia has boasted of her air power and her equipment for chemical warfare—a terribly ominous phrase. While the Soviet arms, no sane country in Europe can safely throw away its sword, and when all others are armed, Great Britain cannot afford to walk about with an empty scabbard at her belt.

The time for presenting the fighting Estimates to Parliament is approaching, and all three sets are to be examined together. In all three Services there is much leeway to be made up, and rivalry between the three must be sternly condemned. In the Navy and in the Air Defence of Great Britain we particularly hope to see substantial increases. At the same time, we hope for a reduction of income tax, which will help trade, and so make it easier to spend more on defences next year. Therefore we cannot expect that the whole shortage of 10 squadrons will be made good in the current year. Probably four squadrons will be raised for Air Defence of Great Britain, while another must be provided to take the place of No. 100 (Bomber) Squadron which has been transferred from the Coastal Area to the Far East Command at Singapore. Of the four A.D.G.B. squadrons, possibly some will be Auxiliary Air Force units, and these are so efficient and so cheap that to add to their number should meet with general approval. It seems very strange that so far there is no County of Lancashire Squadron, and that might be put right. We certainly hope that in the Estimates the number of Regular fighter squadrons will be increased. We should like to see a new squadron or two equipped with the two-seater fighter, the "Demon."

As we explained in a recent article, the fighter aeroplane is the clearest case of a defensive weapon. We have only 13 fighter squadrons at present, and that number is not nearly enough to stand the wear and tear of continuous day and night fighting, especially as only 10 of them are regarded as day-and-night fighters. Nothing could be more futile than for the Disarmament Conference to consider the abolition of fighter aircraft. With fighters all abolished, every civil aeroplane would be a potential bomber. Against well-trained fighters, the amateur bomber would stand a very poor chance indeed. In fact, the only conceivable plan of ensuring that civil aircraft should not be "misused for warlike purposes" is to maintain strong forces of fighter aircraft, with the necessary complement of guns, searchlights, and sound-locators. We note with interest that General Göring, in an interview granted to the *Daily Mail*, calls the idea of using civil machines for attack "absurd." For one thing, he said, they cannot climb fast enough.

While it is absolutely necessary to make a start in bringing the number of A.D.G.B. squadrons up to the 11-year-old standard of 52, it is no less necessary to proceed steadily with the work of replacing out-of-date types with new ones. In the case of the standard day-and-night fighter, the "Bulldog," no good will be done by showing impatience. The new type which has been selected, the Gloster "Gauntlet," will first be supplied to one squadron, as is the custom, and when it has been proved satisfactory it will be given to all fighter squadrons except the interceptors and the two-seaters. The case of the night bombers is worse. There are eight of these squadrons, five of them Regular and three Cadre, of which only No. 99 (Bomber) Squadron has yet been equipped with the new Handley Page "Heyford." The remainder are still flying machines of ancient type, "Virginias" and "Hinaidis." To be inefficiently armed is almost as bad as being unarmed, and with our ancient night-bombers we could do little in the way of striking at the enemy's munition factories. There should be no delay in providing at least the four other Regular squadrons with the new "Heyford." These squadrons have 10 machines each, and an order for 40 or 50 twin-engined bombers will cost some money, but we cannot afford to be both few and ancient.

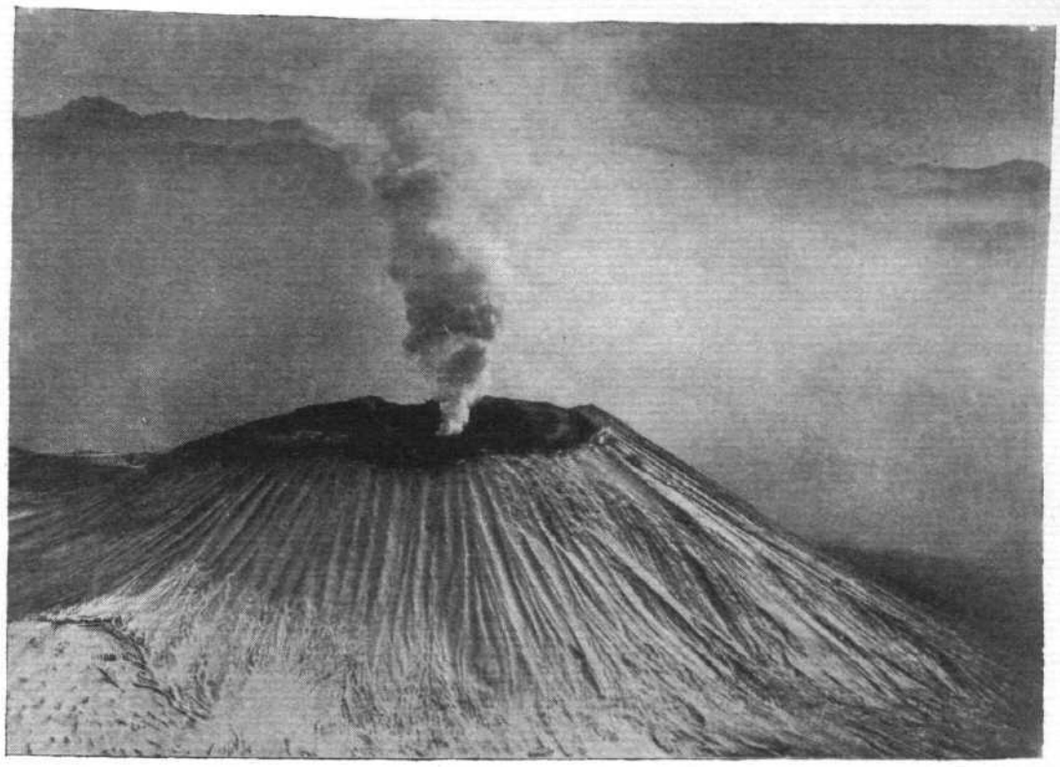
❖ ❖ ❖ ❖

In these days, when we are still vainly trying to make good the objects of the war which was to "make the world safe for democracy," and when many are inclined to question the usefulness of the hereditary principle, it is helpful to remember that not seldom in the history of the world have men whom the accident of birth has placed on a throne proved themselves outstanding as administrators, as statesmen, and as warriors. The debt owed by England to the dynasties of the West Saxon kings, the Plantagenets, the Tudors, and the House of Windsor, is too great to be easily assessed. To take but two names, no Prime Minister and no General in our history can rival the glory, the greatness, and the services to England of King Alfred the Great and King Edward I. Cases from the history of other nations could be quoted in very great numbers.

ALBERT King of the Belgians, K.G., D.F.C.

Wherever a list is made of men, kings or subjects, who have been Heroes of the Nations, Albert, King of the Belgians, will always be mentioned with especial honour. Little was known of him when the great German cyclone burst upon his little kingdom. He rose to the occasion as only a truly great man could do, and in adversity and defeat he found his greatest glory. As *Punch*, in an inspired cartoon at the time, remarked, he lost everything except his soul. His sacrifice was not in vain. He played no small part in defeating the German aims. Afterwards he commanded a victorious Allied army, and ultimately he entered his capital as a victor.

Since then his work has been unceasing, and always he has worked for good. By the aeronautical world he will always be remembered as a great upholder of air transport. Wing Com. Howard-Williams, M.C., who had the honour of flying the King about in East Africa, writes of him in his book . . . *Something New out of Africa*: "I cannot conclude this account without saying how delightful, courteous and gallant we found our Royal passenger. Nothing was too much trouble for him, no thought on our behalf escaped his notice; and he left us all with a very vivid impression of an exceedingly gracious gentleman."



CAMPANIA'S KNELL: Contrast the steep sides of Vesuvius shown here with the lesser gradient of Etna. Here the lava can flow direct in straight rivulets and is not held up in a contorted glutinous mass.

Wonders of Nature Viewed from the Air

By Wing Commander SIR CHRISTOPHER J. QUINTIN BRAND, K.B.E., D.S.O., M.C., D.F.C., Director General of Aviation in Egypt

THIS short account was written by one who had the good fortune to have a passage in *Helena*, one of Imperial Airways air liners, flying out to Egypt to reinforce the company's fleet in that region. The route to be followed included Rome, Naples, thence via Sicily, Malta, and Benghazi, to Cairo.

A two hours' stop at Rome (Littorio Aerodrome) for lunch, also for refuelling the aircraft, provided the opportunity of a Holy Year visit to St. Peter's of 12 minutes only, but better this than not to have seen it at all. What a glorious place it is! The vastness of the Holy Place—the beautiful sculptures, mosaics and reliefs cause one to be spellbound in admiration of the exquisite workmanship of the artists and craftsmen who have laboured on its adornment during past centuries for the Honour of God. Let it suffice to say that none should forgo the opportunity of visiting St. Peter's—this most magnificent of all churches.

On our departure from Rome the Captain promised us the opportunity of viewing, at close quarters, Vesuvius, which was in action. The wonders of St. Peter's and the interesting prospect before us no doubt stimulated the powers of observation during the next two stages of our journey, and accounts for this effort which, it is earnestly hoped, will be considered as worth reading.

At 15 miles from Rome we passed over a large circular lake named Albano, which quite obviously is in the centre of an extinct volcano. The inner slopes, down to the very edge of the lake, are cultivated and the outer lower slopes are covered with trees. The high country thereafter to the left of our course was noticeable for its dense forests which cover the entire surface of the lofty heights and deep valleys. There is no visible rock whatever, and it is obvious that deep soil extends over, or is abundant throughout, these wooded slopes. (Reference will be made again to this area towards the conclusion of these notes.)

Mount Vesuvius was shortly afterwards identified on the distant horizon by the smoke ascending from its apex. Some 10 miles north of Naples there are numerous depressions in low conical hills—these depressions are all cultivated and the outer slopes are in most cases thickly wooded; all are covered with verdure of some kind. To the south-east of this conical hill area a vast plain, extensively planted with vines, extends to the outskirts of Naples and to the slopes of Vesuvius. The vines are supported on wires stretched between trees planted in rows; these rows being about twenty metres apart and the intervening soil cultivated with small crops.

We approached Vesuvius climbing round its north and west slopes. The upper portions of these slopes are covered with what appears to be rich reddish-purple looking loam; much verdure, apparently self-sown young trees, extends, or is extending, well up the middle slopes in the reddish-purple loam. No recent lava deposits were visible until we passed round to the east or south-east side—here enormous deposits of a slowly moving purplish-black mass extended far down the mountain side. Centrally in this mass, and as far down as 1,000 ft. below the lip of the old crater, glowing red areas were visible. We were now flying only a few hundred feet above and away from the lip of the old crater, and what an amazing sight indeed was before our eyes! Approximately in the centre of the old crater a new conical hill had formed, and it was from this apex of the conical hill that a vast column of smoke was issuing and ascending vertically a thousand feet or more before being carried away horizontally in a moving layer of air at that higher altitude. Every now and again there would be a more vigorous gushing of smoke and the red glow of the fiery interior of the mountain became visible in the belching smoke; the redness may possibly have been actual gas flames. The top of the smoking cone had apparently split and it was from this split that the lava was issuing into, and partly filling, the southern hollow portion of the old crater. The slow moving mass, mainly dark tones of purplish-black and somewhat glazed, but with glowing red areas from which yellowish sulphurous smoke issued, was flowing round to the point of discharge and down the mountain side. The spectacle was indeed awe-inspiring, and one wonders why the mountain does not burst asunder when there is a great disturb-

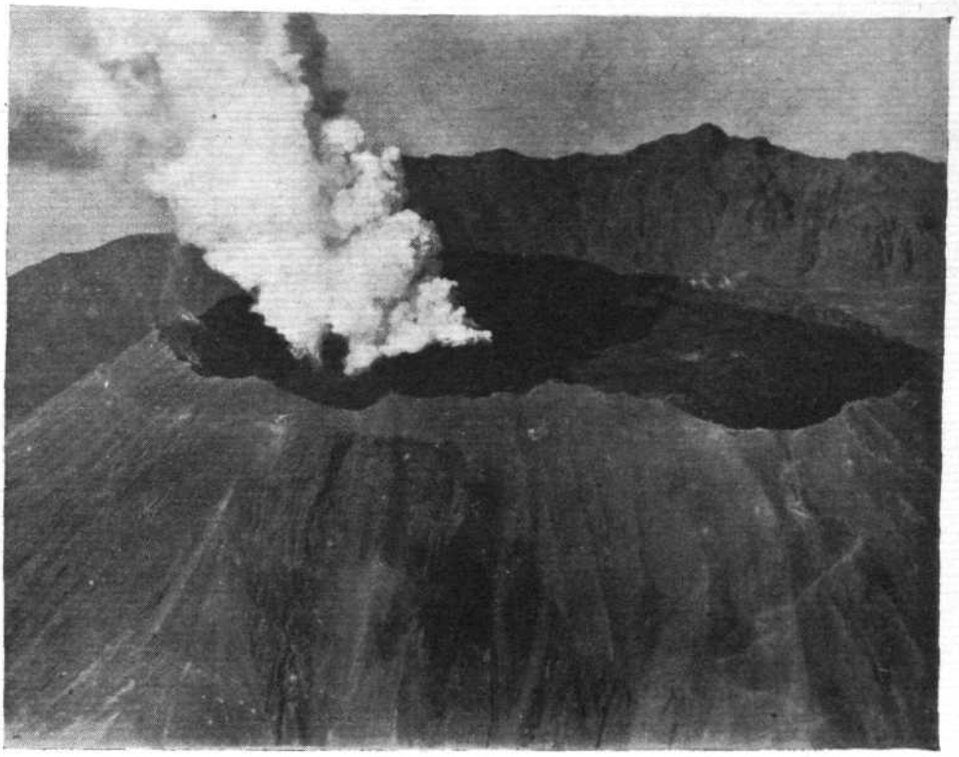
ETNA : The slopes of Etna are gradual, so that the lava flow is slow, allowing it to take the weird contorted shapes shown, as it cools on its surface

ance internally. It is probable that something of this kind did occur when Pompeii and Herculaneum were engulfed and accounts for the size of the old crater which is many times the diameter of the present active one.

The outstanding thought in our minds as we returned from viewing Vesuvius was—what is the object of it all? And because we were travelling by air the answer was before our eyes the next day, when travelling over Sicily, Mount Etna, and the country in the course southwards towards Malta. Mount Etna, nearly 11,000 ft. high, was steadily and calmly issuing smoke from its apex—the opening from which the smoke issued appeared to be a couple of hundred yards in diameter, many times smaller than the old crater of Vesuvius. Here again the slopes were mainly covered with what appeared to be reddish-purple loam. The black streams visible and reaching far down the valley must have issued from the east or south-east side of the crater—we unfortunately did not pass round to these sides. A remarkable thing to notice is that in this case the very high pressure of some past eruption caused the formation of smaller discharge craters on the mountain side and numbers of these are visible, some isolated, but others in groups (five or six in number) stepped one above the other up the slopes of the mountain.

It can clearly be seen that these first formed as small conical hills pushed out from the side of the mountain, and when eventually the discharge broke through the tops, gravity caused the lava to flow over the lower edges. The direction of the flow of what was originally the purplish-black mass is obvious from the air, but in the course of time and process of Nature it had turned into this reddish-purple substance, which looks like rich loam. Whatever it is at present it, in due course, becomes rich soil, because trees and foliage grow and develop naturally on areas which were originally lava deposits. It was also interesting to observe on the mountain side several dwelling houses still standing in the midst of small areas of originally cultivated soil, but these small areas are completely surrounded by lava streams of considerable depth, some obstruction above the little homesteads having divided and deflected the streams, which, however, re-united again some distance below the little homes. It

ST. PETER'S : A magnificent aerial view of Rome showing St. Peter's and the Vatican City



SUPPRESSED NATURE: A near view of Vesuvius which shows the observation hut on the lip of the large old crater and the point to the right where the lava has broken through the wall of the outer cone and is flowing down the side.

could not be determined, however, whether any of these homes were in occupation or not, at the present time. As one views the country south of the mount, bearing in mind all one has seen at Vesuvius and on the journey from Rome, one gets an appreciation and understanding of the ways of Nature and the stages in the "Creation" or subsequent evolution of this earth as one could never hope to obtain by reading.

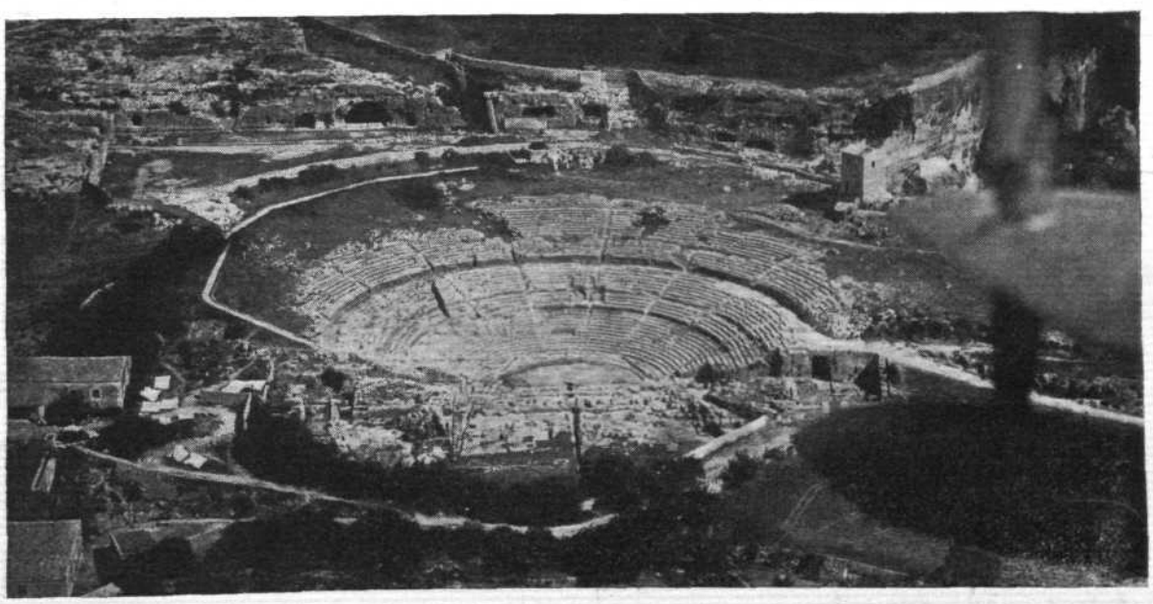
As we flew southwards the country changed its characteristics, and soil was observed to come more and more scarce (bare rocks more and more predominant in the landscape); water-courses cease to hold water and are obviously only rushing torrents after rain. What was once countryside with abundance of soil is now an irregular area of small, almost bare, plateaux intersected by bare deep rock channels almost devoid of soil.

In southern Sicily and Malta similar methods are adopted in an endeavour to preserve or retain the diminishing soil. As the depths of soil are reduced, so more and more loose stones abound, and the farmer is obliged to move them. He therefore builds loose stone walls round the various plots of his land which are being cultivated—these walls have several purposes; they keep cattle out of growing crops, but principally they serve to retain the little soil that remains and prevent the formation of rushing torrents which would wash away the soil during rainy weather. Vast numbers of heaps of stones are visible in the sparse soil areas of South Sicily, all collected from the soil to make it cultivatable. One can only assume that past generations of people in these parts have failed to realise what was happening or to take any measures for conserving the soil, and, owing to extensive and finally complete deafforestation, it has washed away steadily into the sea, down the ever-increasing number of bare rocky water-courses.

It would appear that these southern portions of Sicily have nearly completed a cycle of evolution and are back again almost to a condition corresponding to the first stage in the formation of this earth, when the molten masses commenced to cool down and waters of the seas to form; only that in the present stage the earth is cooler. As a result of all one can see from the air, it requires no effort of mind to picture the probable subsequent stages of development—"Biblical stages of creation." As the outer layers cooled and formed rock, stresses were set up and volcanic disturbances occurred which forced up the mountain ranges and at weak spots volcanoes broke out to act as pressure vents. In the action of releasing internal pressures lava was thrown up and spread over the surrounding rock masses and later became soil to produce the vast forests and undergrowths which still later supported the prehistoric monsters of that period, when these were created.

Our present coal deposits being formed by subsequent avalanches and landslips burying vast forests, the storms and deluges of rain in the ages of time continuing the

(Concluded on page 183)

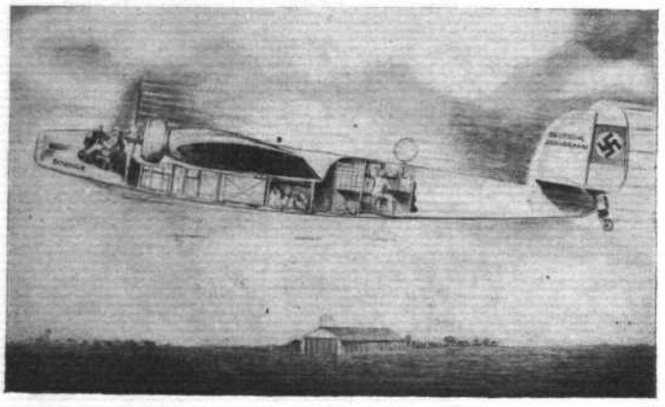


BIRTHPLACE OF ARCHIMEDES: Although Syracuse was founded in 732 B.C. by Archias, many of the Greek remains, like this Theatre, are still well preserved.

Air Transport & Commerce

A DORNIER FREIGHTER

ONE of the latest products of the Dornier Metallbauten G.m.b.H., of Friedrichshafen, is the Do.F twin-engined freighter intended for use on the aerial freight connections of the German railways. The aircraft is a mid-wing monoplane, the constructors having decided on this type as loading hatches were required on top of the fuselage. A metal wing of semi-cantilever construction is used. This is in two parts, and has three spars. Metal is used for covering the leading edge, and the remainder of the wing is fabric covered. The fuselage is a duralumin structure with rectangular section bulkheads. In the nose is a storage for spare parts, and a cockpit with dual controls and side by side seating, with entrance underneath. Immediately behind the cockpit is the freight compartment, mail cabin, wireless and D/F equipment. On top of the fuselage is a hatch measuring about 4 ft. by 2½ ft. Duralumin is used for the tail unit with fabric covering. The rudder is balanced and is fitted with servo control, and the tail plane is adjustable in flight. A retractable undercarriage is fitted, which incorporates two struts on each side of the aircraft attached to the fuselage and a shock absorber connected with the wing. A swivelling tail wheel is fitted.



THE DORNIER Do.F.

Length	61 ft. 4 in.
Height	18 ft. 2½ in.
Span	91 ft. 10 in.
Wing area	1,196 sq. ft.
Weight empty with equipment	10,500 lb.
Gross flying weight	17,600 lb.
Wing loading	14·75 sq. ft.
Power loading	16·1 lb./h.p.
Top speed	155·3 m.p.h.
Cruising speed	137 m.p.h.
Landing speed	62·3 m.p.h.
Climb to 9,840 ft.	25 min.
Ceiling	15,400 ft.
Range	530 miles
Useful load	4,400 lb.

Two 550 h.p. Siemens "Jupiter" geared engines are fitted in nacelles in the leading edge of the wing. Low drag ring cowlings are used. Aluminium fuel tanks in the wing have a total capacity of 396 imperial gallons and an oil tank, also in the wing, holds 32 gall.

AIR-FRANCE ACTIVE

THERE is a probability that the Marseilles-Algiers route of Air-France will be open for passenger traffic in May, when a service of Lioré et Olivier flying boats (four Gnôme-Rhône K.7's) will be inaugurated. These boats, it seems, may have difficulty in alighting on the Lake of Tunis (El Bahira), which is very shallow. Dewoitine D-332's and 333's, which are being built, are being strengthened. Fourteen aircraft of these types have been ordered, and some (the type 333's) will have cabins for 24 passengers. These will be used on the old Cidna routes and for the Paris-London services. During the course of this year Dewoitines will be put into service on the Natal-Buenos Aires connection. Air-France may extend their Indian service to Hong Kong, but the requirements of the Canton Government may cause some delay. The participation of Air-France with Sabena in the running of the Algiers-Congo section is being considered. Great endeavours are being made to develop direction finding wireless on the systems of Air-France.

MISR-AIRWORK ACTIVITIES

DURING the week ending February 6, 134 passengers were carried on the Cairo-Alexandria air line, and 16 passengers on the Upper Egypt bi-weekly service, operated by Misr-Airwork S.A.E. This is a distinct increase. A Misr-Airwork twice-weekly service to Palestine, serving Port Said, Gaza, Jerusalem and Haifa, was scheduled to commence on February 15. The journey right through, inclusive of all stops and Customs clearances, will occupy 4½ hours, as against over 14 hours by train. On February 3 the Misr-Airwork "Dragon" at Aswan took ex-King Alphonso of Spain and his equerry for a trial flight, and His Majesty expressed his great admiration for the comfort and silence of the aircraft.

ROME-TUNIS-ROME IN ONE DAY

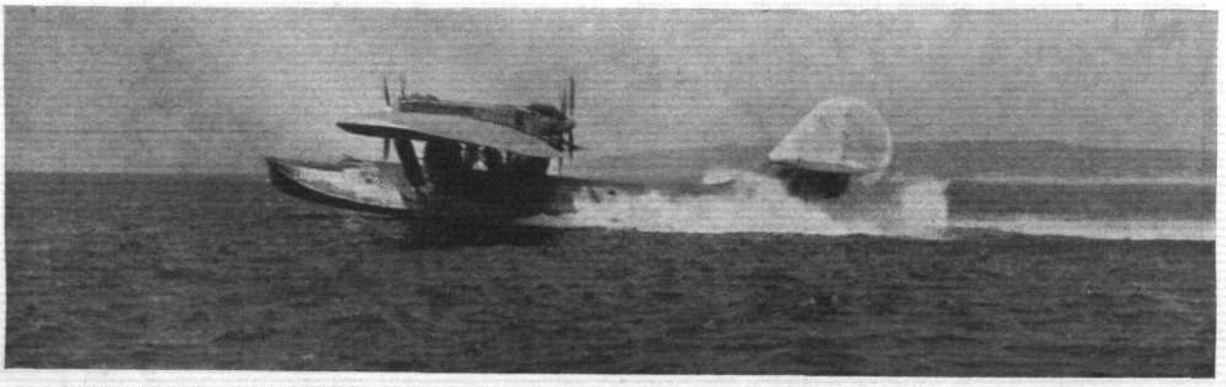
ON February 7, a Savoia Marchetti S.66 triple engined flying boat of the Societa Aerea Mediterranea made an experimental flight between Rome and Tunis. The machine left Rome at 7.30 a.m., reached Tunis at 10.15 a.m., took off again at 2 p.m., and arrived back in Rome at 5 p.m. Twelve passengers were carried in addition to the crew and the machine proved itself capable of maintaining a cruising speed of over 125 m.p.h. Thus a connection between Europe and Africa is possible in less than three hours.

GREEK TRAFFIC STATISTICS

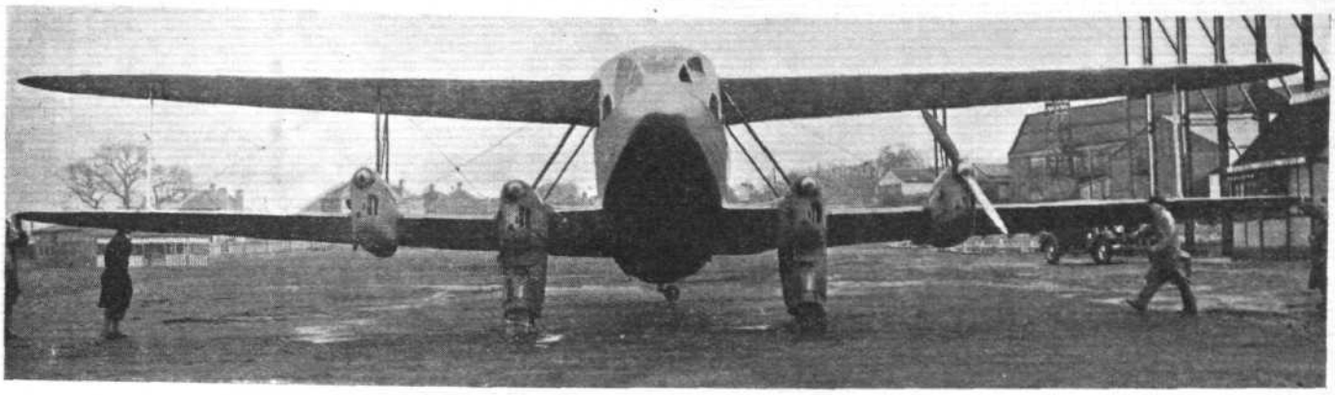
DURING 1933, the Société Hellénique de Communications Aériennes obtained the following results: 1,007 flights, 234,000 miles flown, 95 per cent. regularity, 5,864 paying passengers, 141,000 lb. of luggage, 22,000 lb. of mail and 298,000 lb. of freight.

BOLIVIAN AIR TRAFFIC

LLOYD AÉRO BOLIVIANO, of Cochabamba, Bolivia, gives the following traffic figures for November, 1933:—283 flights, 2,381 passengers, 1,565 lb. (711 kg.) mail, and 328,000 lb. (149,103 kg.) freight, over 630,000 miles (101,297 km.).



ON THE SOUTH ATLANTIC SERVICE: The Latécoère 300 flying boat. It was on this type of machine, the *Croix du Sud*, that Capt. Bonnot made the double crossing recently.



SPEED WITH SAFETY

Built for Imperial Airways, Ltd. and Quantas Empire Airways to comply with the conditions of the Australian Government tender for the Empire Air Route extension from Singapore to Darwin and Cootamundra, the new De Havilland Express Four-engined Air Liner provides exceptionally fast and safe air travel

TO design and build a four-engined aeroplane and to obtain for it a certificate of airworthiness all in a period of four months is no mean feat, in fact, we venture to suggest that it must be quite unique ; yet this is what the de Havilland Aircraft Co., Ltd., have done in their works at Stag Lane, and their "Express Air Liner," the first details of which we give in the following pages, is the result of wonderful keenness and co-operation by all departments of this company.

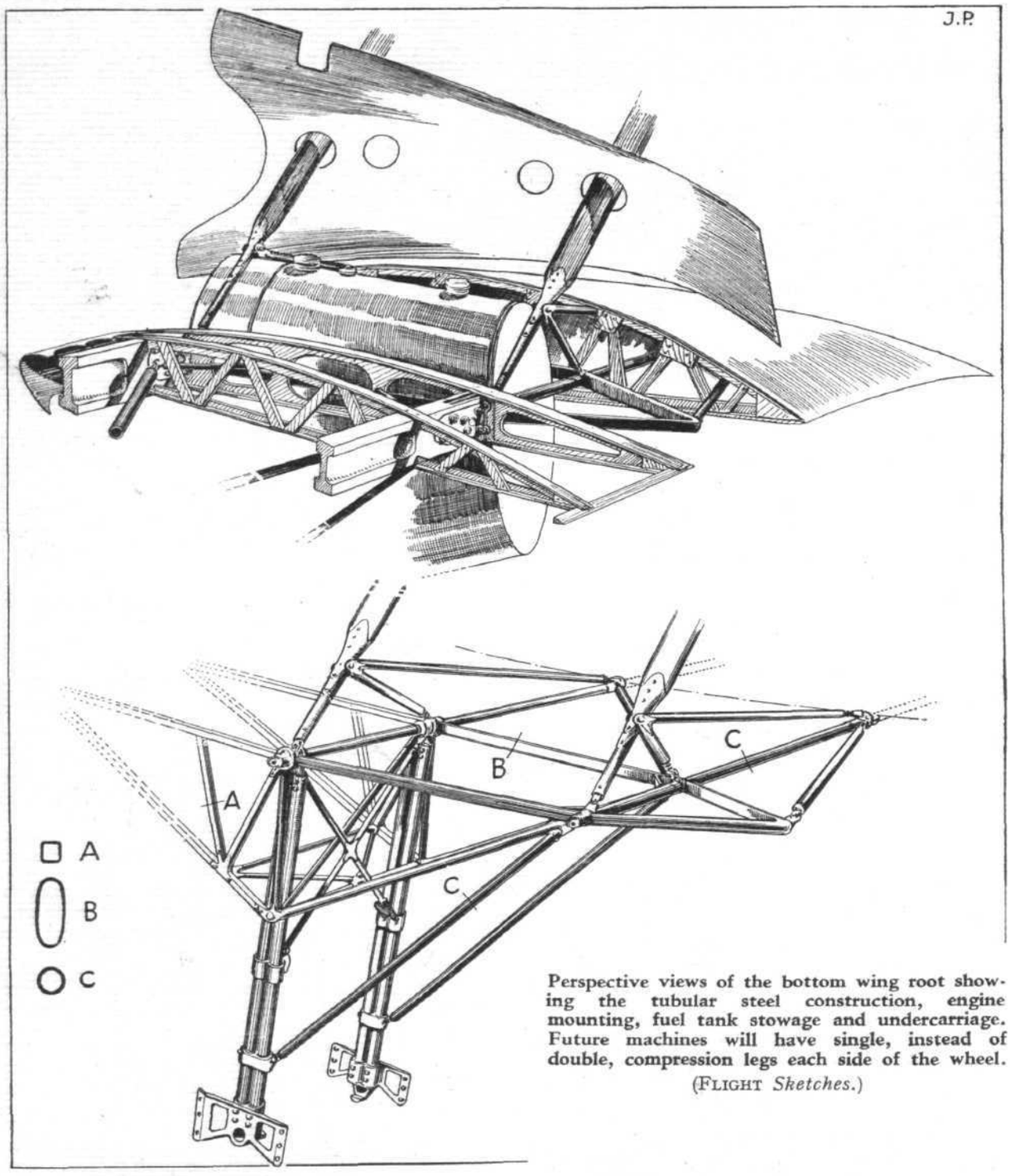
On September 28 last year we gave in FLIGHT the details of the conditions of tender issued by the Australian Government for the Singapore-Darwin-Cootamundra section of the England-Australia air mail service. It will also be remembered that some little time before that we published the result of a talk with Mr. Hudson Fysh, Managing Director, Queensland & Northern Territory Air Services, Ltd. Mr. Hudson Fysh was at that time in England concluding arrangements with Imperial Airways for collaboration between them and his firm for this tender.

At the same time the de Havilland Aircraft company submitted a proposal for a four-engined airliner with a high performance and a wide margin of safety in the event of engine failure. It was seen that the proposed type was not only capable of conforming to the Australian requirements but that it would exceed the minimum performance needs handsomely. A contract was therefore placed by Imperial Airways on behalf of the newly formed firm, Quantas Empire Airways, for one of these aeroplanes to be built and used as a basis for their tender to the Australian Government. A condition of the tender was that the aeroplane submitted had to possess a certificate of airworthiness on the closing date for the tenders, which was January 31, 1934. The task, however, though great, proved not to be beyond the resources of the factory, and the C. of A was obtained on January 30. It will be remembered that we published some of the first flying pictures of this machine on January 18. Not only had every detail of the machine to be designed and manufactured in this period, but the "Gipsy Six" engine, which was then only in its early stages of development, had to be brought through its teething troubles and to obtain its Air Ministry Type Test ; moreover, four engines had to be completed for installation in the new machine.

Everything went according to programme. The machine was first flown by the firm's test pilot, Capt. H. S. Broad, on January 14, and during the following week the D.H.86, as she is officially known, passed through the Aircraft Experimental Establishment at Martlesham for airworthiness and handling trials.

It will be seen from the artist's impression that the cabin space is particularly large, naturally, therefore, permitting a variety of arrangements. As shown, accommodation is provided for ten passengers, with a lavatory and luggage compartment, and when Rumbold's have finished the upholstery it will be a very comfortable job. It is probable, however, that for the England-Australia service, should the tender be accepted, the lavatory will be brought forward and a large mail compartment built behind it, thus decreasing the passenger accommodation by two. This sketch also shows the deep long windows which are built

This three-quarter front view gives a good idea how neatly the engines are faired into the bottom wing, while the top view shows the general cleanliness and tapered wings. (FLIGHT *Photos.*)



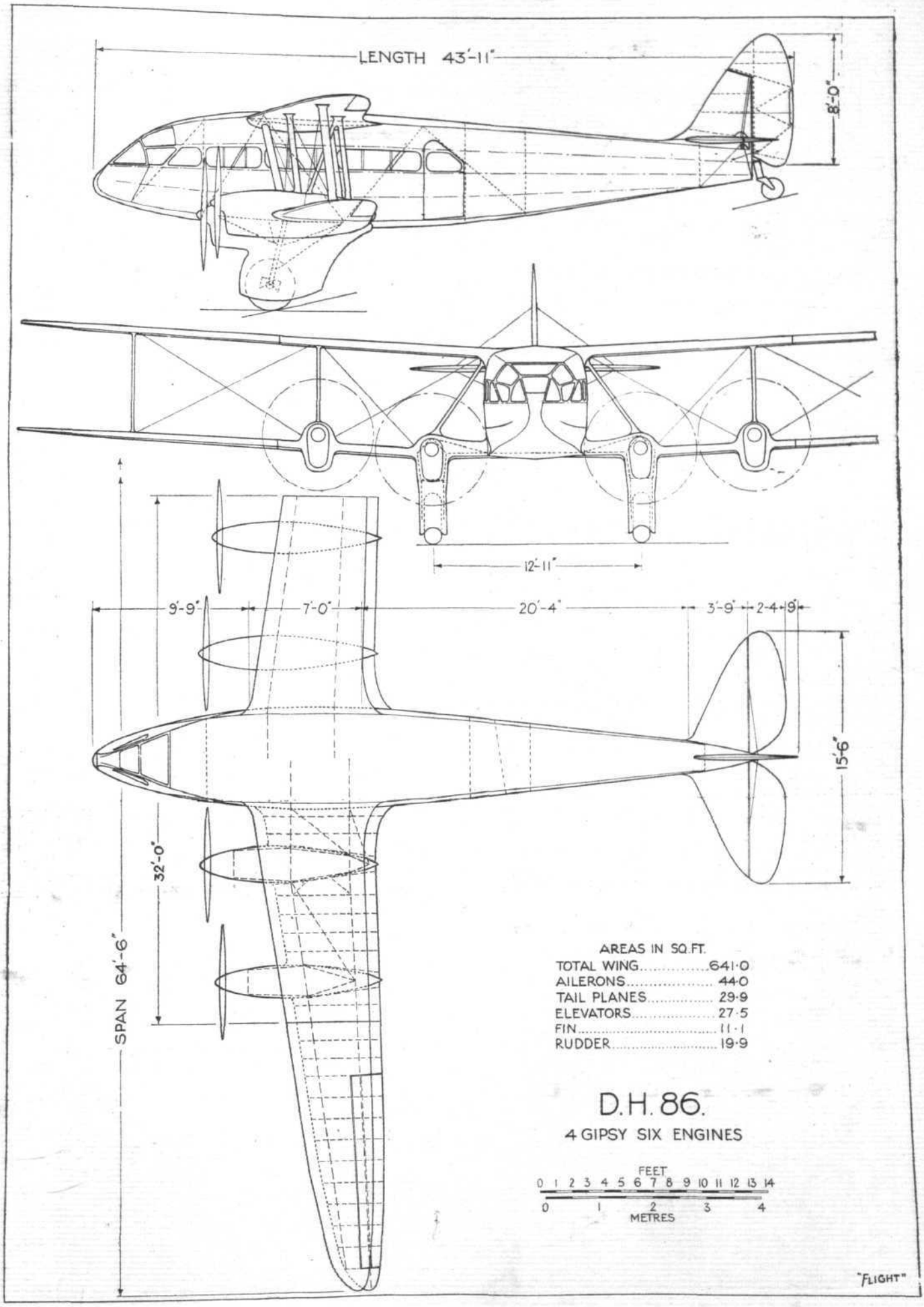
Perspective views of the bottom wing root showing the tubular steel construction, engine mounting, fuel tank stowage and undercarriage. Future machines will have single, instead of double, compression legs each side of the wheel.
(FLIGHT *Sketches.*)

either side of the fuselage, making the cabin light and pleasant, a feature which is enhanced by the two top lights normally provided in the roof of the cabin through two emergency exit panels. There is generous head room as the average height of the cabin is 6 ft. 3 in. (1,9 m.), and the total cubic capacity in the machine available for the carriage of load is 594 cu. ft. (16,82 m³.). A fully controllable fresh-air ventilator system, which ventilates without causing draught, and a cabin-warming equipment is, of course, fitted.

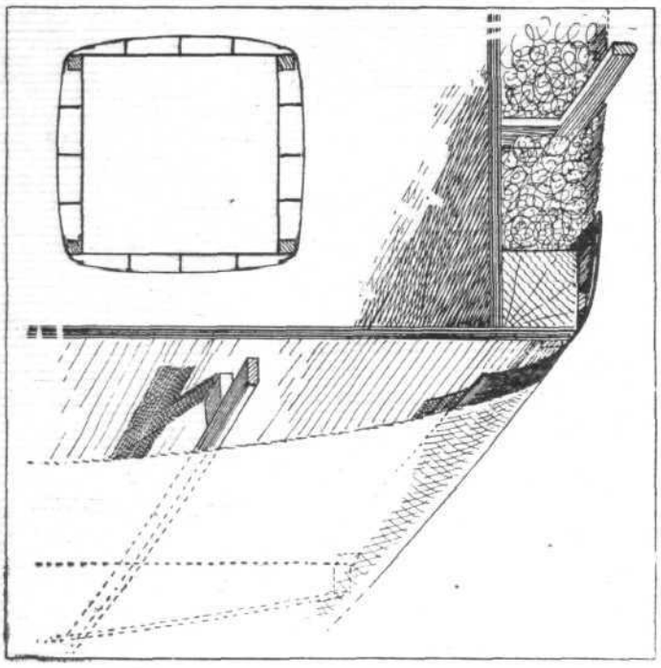
The machine has not got dual control in its present form, but the pilot sits right forward in a cabin separated from the passenger compartment by a bulkhead and door. In this position he has a well-nigh perfect outlook, and the slope of the windscreen, combined with the speed of the machine, should obviate any obstruction of the glass due to snow or rain. Nevertheless, the two large side panels are single pieces of Triplex glass which may easily be lowered, to give a clear and unobstructed outlook forward and to the side. The second member of the crew is accommodated on the starboard side of the pilot and behind him, in which position there is ample room for a full wireless equipment as well as a chart table and stowage for the navigating equipment generally.

Structurally the "86" is interesting, as it is the first machine incorporating a new method of using plywood and spruce. Our artist's sectional sketch shows that the fuselage is primarily a three-ply box, but it has this great difference from the normal type, in that the fuselage is built with the plywood inside the box, and with the spruce longerons, struts and stringers, outside it. Outside this again is a complete fabric covering, doped, as are the other covered units, with Titanine, giving a weatherproof and durable finish. This method of forming the fuselage provides clear walls, floor and roof, and also conserves space, as the sound proofing material, in this case Cabot quilting, can be packed between the plywood and the fabric in the space made by the longerons and stringers. Aft of the main planes sheet Elektron guards are placed over the corners of the fuselage, serving both to give a better shape to the fuselage and to obviate taking the fabric over the otherwise sharp corner.

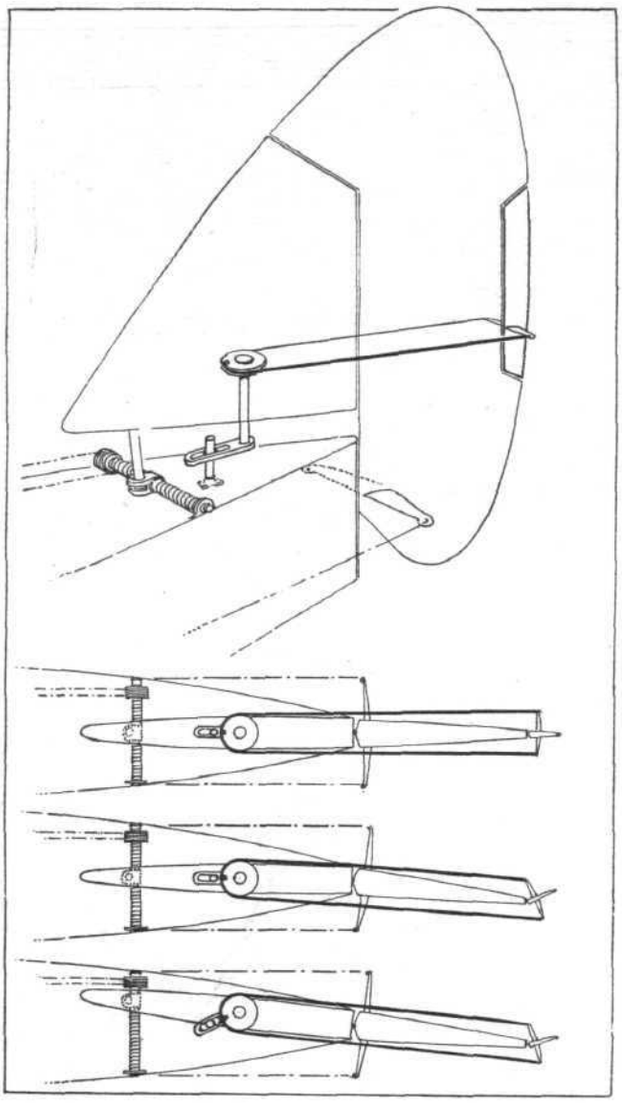
The tail units are, in general, normal de Havilland design and construction. Their shape is, of course, typically "D.H.," and their construction is of spindled spruce spars, fairly substantial spruce ribs, and a covering of 0.8 mm. plywood. Over the whole there is a covering of fabric and then the usual dope. The elevators (and the ailerons) are not aerodynamically balanced and are controlled by straightforward dual cables between the control



A general arrangement drawing of the D.H. "Express Air Liner."



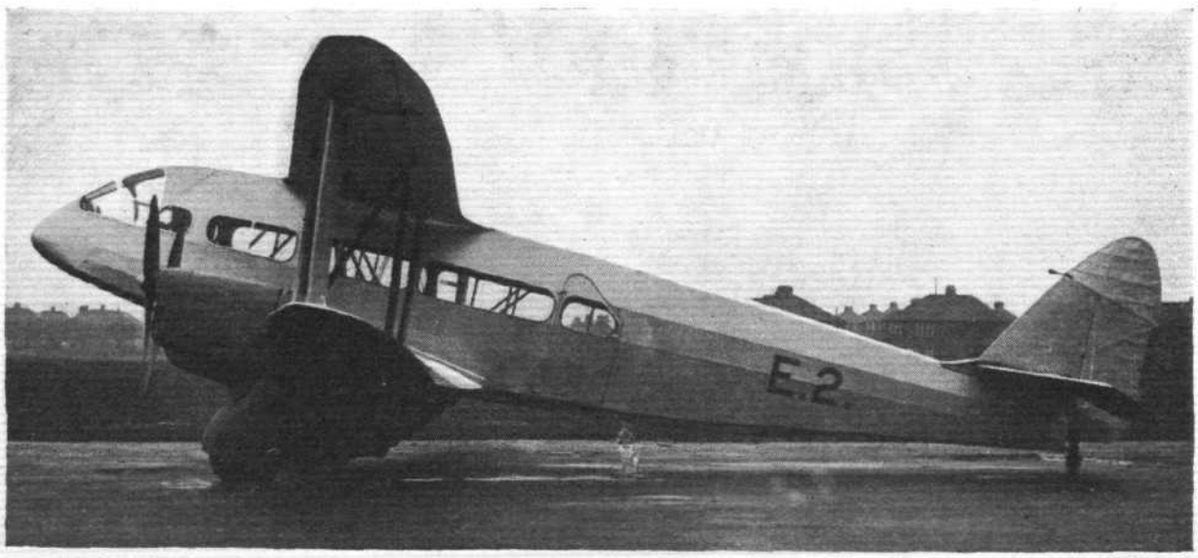
A sketch showing the fuselage construction at the cabin. (FLIGHT *Sketch.*)



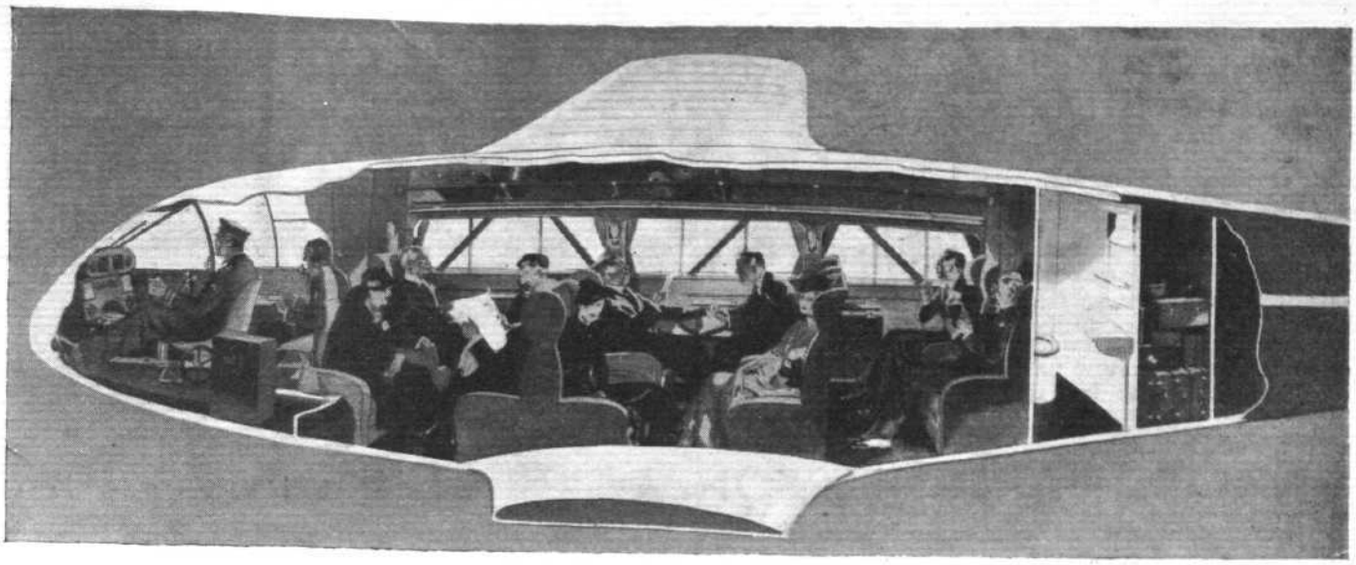
These diagrams illustrate the operation of the fin offsetting adjustment and rudder balance. (FLIGHT *Sketch.*)

column and top and bottom steel horns on the centre of the elevator spar. The tail plane is adjustable throughout a wide range by a vertically mounted square cut screw acting on the leading edge and controlled by an endless cable from a handwheel in the pilot's cockpit. The fin is particularly interesting, because it, also, has its leading edge mounted on a similar screw, allowing it to be offset either side, thus counteracting the unbalanced thrust in the case of engine failure. The rudder is also balanced by means of a small movable surface inset into its trailing edge. This, being attached to the fin by means of cables either side of the rudder, automatically produces a balancing force when the rudder is operated by the main controls. The attachment point on the fin is mounted on a vertical rotatable tube having at its lower end a fore and aft horizontal slotted lever with a pin fixed to the fuselage through the slot. When the fin is offset by its own trimming device the tube will rotate, operate the balance, and compensate the rudder for the effect of the offset thrust. The fully castoring tail wheel is fitted with rubber blocks in compression to absorb the shock of landing.

The wing construction, as regards the outer portions, is more or less standard "Dragon," the heavily tapered aerofoil section being R.A.F.34 modified. The spars are of spruce, spindled to "I" section. The ribs are of spruce fixed to the spars with the "D.H." capping clips of light alloy. The drag bracing is, for the most part, of double piano wire with steel drag struts. The leading edge is completely covered with plywood which is carried right back to the rear spar round about the region of the single



The foreshortening effect of this side view makes the "Express Air Liner" look somewhat ugly, but in point of fact this is far from the case, largely due to the heavily tapered wings. (FLIGHT *Photo.*)



An Artist's impression of the inside of the D.H. "Express Air Liner" showing the seating arrangement for ten passengers. It can be seen how light and comfortable the cabin is.

D.H. "EXPRESS AIR LINER"
Four "Gipsy Six" Engines

	ft.	in.	m.
DIMENSIONS			
Span	64	6	(19,66)
Length overall	43	11	(13,39)
Height overall	12	6	(3,81)
Mean Chord	5·29		(1,61)
Aspect ratio	12·3 : 1		
Incidence (both main planes)	1·5 *deg.*		
Dihedral (both main planes)	3·0 *deg.*		
Sweepback (both main planes)	4 *ft.* 9 *in.* (1,45 *m*)		
Gap	6 *ft.* 4·8 *in* (1,95 *m*)		
Stagger	8·5 *in.* (216,8 *mm*)		
AREAS			
Main planes, inc. ailerons and body	641 *sq. ft.* (59,55 m^2)		
Ailerons, four	44·0 *sq. ft.* (4,09 m^2)		
Tail plane	29·9 *sq. ft.* (2,77 m^2)		
Elevators, two	27·6 *sq. ft.* (2,56 m^2)		
Fin	11·1 *sq. ft.* (1,03 m^2)		
Rudder	19·9 *sq. ft.* (1,84 m^2)		
WEIGHTS			
Tare weight	5,520 *lb.* (2 503,83 *kg*)		
Disposable load—			
Crew	340 *lb.* (154,22 *kg*)		
Fuel (114 *gall.*—518,4 *lit.*)	855 *lb.* (387,82 *kg*)		
Oil (12 *gall.*—54,5 *lit.*)	116 *lb.* (52,61 *kg*)		
	1,311 *lb.* (594,65 *kg*)		
Cabin furniture	270 *lb.* (122,47 *kg*)		
Wireless equipment	130 *lb.* (58,97 *kg*)		
Lavatory	30 *lb.* (13,61 *kg*)		
Pay load	1,939 *lb.* (879,51 *kg*)		
	2,369 *lb.* (1 074,56 *kg*)		
Maximum permissible weight	9,200 *lb.* (4 173,04 *kg*)		
LOADINGS			
Wing loading	14·35 *lb./sq. ft.* (70,06 *kg*/m^2)		
Power loading	11·2 *lb./b.h.p.* (5,08 *kg/b.h.p.*)		
ENGINES, *four* "GIPSY SIX" *each, giving* 184 *b.h.p. at* 2,100 *r.p.m.* 205 *b.h.p. at* 2,350 *r.p.m.*			
Fuel consumption	36 *gall./hr.* (163,65 *l./hr.*) at 145 *m.p.h.* (233,36 *km/h at* 2,000 *r.p.m.*		
PERFORMANCE			
Top speed, over	170 *m.p.h.* (273,59 *km/h*)		
Landing speed	72 *m.p.h.* (115,87 *km/h*)		
Cruising speed, at 2,000 *r.p.m., over*	145 *mp.h.* (233,36 *km/h*)		
Climb, from rest, 1 *min.*	1,200 *ft.* (365,76 *m*)		
" " 2 "	2,300 *ft.* (701,04 *m*)		
" " 3 "	3,250 *ft.* (990,60 *m*)		
Ceiling, absolute	20,500 *ft.* (6 248,4 *m*)		
" *service*	19,000 *ft.* (5 791,2 *m*)		
" *on* 3 *engines at* 92 *m.p.h.* (148,06 *km/h*)	15,000 *ft.* (4 572,0 *m*)		
" *on* 2 *engines on the same side, under full control*	3,600 *ft.* (1 097,3 *m*)		

interplane strut separating the top and bottom planes in the outer bay. This strut is a streamline steel tube and in subsequent models of this machine the aileron interconnecting gear will, instead of being cables as at present, consist of a tube running up inside this strut. The interplane main bracing is by dual streamline wires in the front bay only. The ailerons are of the same construction as the tail units and are completely covered with 0.8 mm. plywood. They are actuated, as are all the flying controls, by Bruntons "Tru-Lay" cable running over large pulleys without the use of fibre blocks at any point, thus providing a control system with extremely little frictional loss. To facilitate inspection of the controls to the tail units, the fabric in the bottom of the fuselage is brought together with a "Zip" fastener so that it can be opened at any time without difficulty. The inner bays of the main planes are, of course, very interesting structurally, as the bottom one carries all four engines and the undercarriage. Our artist's sketch shows one of the inner engine mountings, built up of welded steel tubes, and incorporating the cantilever undercarriage. In the sketch this undercarriage has dual compression legs either side, but we understand that for subsequent models it has been found, by Mr. Dowty, of Aircraft Components Co., Cheltenham, who has designed this undercarriage, that a considerable saving in weight will be made by having only a single leg either side. Between the points of attachment of the two inner engines the wing spars are continuous underneath the fuselage and are steel tubes of circular section. Those between the roots and the top main planes are the same. The engine mountings are all similar, those of the inner engines carrying behind them fuel tanks of 57 gall. each, each tank sufficing for the two engines on that side. The oil tanks are slung below the engine mountings in the case of the inner engines and behind in the case of the outer engines. The engine cowlings and the fairings over the rear portion of the mounting are all of sheet Elektron, which is chromated before being painted as an anti-corrosion measure. It is interesting to note that, throughout the whole machine, where sheet light alloy is used, as the fairings over the wheels, the frames of the windows and doors, Elektron is used.

The engines have already been described in FLIGHT (January 25, 1934), and there is therefore no need to go into detail here. In this machine they drive Fairey metal airscrews and are fitted with Eclipse direct acting electric starters fed from a 20 ampere electric battery (Caple electric inertia starters can be fitted if required). This seems small, but we are told that 70 engine starts have been obtained from this battery without recharging. Fuel is fed from the tanks to each engine by dual Amal pumps, a type which is now being manufactured by D.H.'s themselves. The fuel cocks will be operated on subsequent machines from the pilot's cockpit, as will be the altitude controls to the carburetters, by Simmonds-Corsey controls. The revolution counters are of the Record electrical type operating neat vertical dials either side of the dashboard. The two Claudel-Hobson carburetters of each engine take fresh air through a Vokes flame trap during slow running, and the throttle control is operated by an endless cable over pulleys from normal levers close to the pilot's left hand. The Bendix wheel brakes, acting in Dunlop wheels with low-pressure tyres, are differentially connected to the rudder bar and controlled by a hand lever in the same way as other "D.H." aircraft.

In the pilot's cockpit the control column is of the spectacle type. The seat can readily be raised for landing. The dashboard, which is very neat though carrying instruments for four engines, swivels forward allowing ready access to the wiring behind it. The trail trim wheel comes readily to the pilot's left hand and the fin trim to his right. A Smith's electric fuel gauge is placed behind, and to the left hand of, the pilot.

FLYING PERSONALITIES OF INDIA

IN these days when flights from Great Britain to India are of almost weekly occurrence, we believe that many of our readers, especially club members and private owners, will like to have a list of the people whom they are likely to meet when they have arrived East of Karachi. We accordingly publish below a list of the flying clubs of India with the names of the officials, and in most cases the telegraphic address, some of which suggest a pretty wit—*e.g.*, Bomfly, Katfly, and Cawflight. The East has always been famous for its great variety of winged insects, but we feel sure that no unpleasant consequences will follow a close acquaintance with Madfly.

To add to the interest of the list we also give the directors of the two newly-formed operating companies, Indian Trans-Continental Airways and Indian National Airways. The Tata Air Lines are a branch of the activities of the great steel concern, Tata Sons, Ltd. The director in charge of their flying interests is Mr. Jehangir R. D. Tata, a member of the Bombay Flying Club, and the detailed management of the service is in the hands of Mr. N. Vintcent. Among the directors of Indian National Airways the name of the ever-youthful pioneer of flying, Mr. F. P. Raynham, will be noticed. It will be remembered that in our issue of November 30, 1933, we published a photograph of the Hon. Rai Bahadur Lala Ram Saran Das, C.I.E., the Government representative on the board of Indian Trans-Continental Airways.

The Director of Civil Aviation in India is Mr. F. Tymms, M.C., and the Deputy Director is Capt. A. T. Eadon. The list is as follows:—

Indian Trans-Continental Airways.—Directors: Mr. P. R. Pinhorn (Chairman), Mr. R. E. Grant Govan, Sir H. Mehta, Hon. Rai Bahadur Lala Ram Saran Das, Choudhri Zafrullah Khan, Rai Bahadur Badridas Goenka, T. C. Sutherland (Managing Director), Wing Com. Measures (Manager, Imperial Airways No. 3 Operating Division), Mr. Rowan (Divisional Engineer), Mr. Tutt (Stores Inspector), Mr. Webb (Asst. to Managing Director).

Indian National Airways.—Directors: Sir Phiroze Sethna, Mr. F. P. Raynham, Sir H. M. Mehta, Hon, Mr. B. K. Basu, Mr. R. E. Grant Govan (Managing Director).

Aero Club of India and Burma.—Patron-in-Chief, His Excellency the Viceroy; Patroness, Her Excellency the Countess of Willingdon; Chairman, Mr. P. R. Pinhorn; Vice-Chairman, Mr. R. W. Targett; Secretary, Wing Com. A. R. C. Cooper; Telegrams, Aeroclub, Simla/Delhi.

Bengal Flying Club.—Hon. Secretaries, Mr. F. S. R. Surita and Mr. M. N. Kanjilal; Chief Instructor, Mr. W. Dougall; Ground Engineer, Mr. W. G. Tomlin; Asst. Ground Engineer, Mr. R. Sebright; Telegrams, Benfly Dum Dum.

Bombay Flying Club.—Assistant Secretary, Mr. B. R. Desai; Assistant Instructor, Mr. R. P. Dhargalkar; Telegrams, Bomfly, Bombay.

Delhi Flying Club.—Vice-Chairman, Mr. K. H. Rugginz; Assistant Secretary, Mr. Sidh Gopal Sarup; Chief Instructor, Capt. A. I. Riley, A.F.C.; Assistant Instructor, Mr. Bhagat B. Lal; Ground Engineer, Mr. C. A. Goodey; Telegrams, Delflight Delhi.

Jodhpur Flying Club.—Hon. Secretary, Mr. J. W. Gordon, O.B.E.; Chief Instructor, Mr. G. H. Godwin; Ground Engineer, Mr. R. D Samuels; Telegrams, Jodflight, Jodhpur.

Karachi Aero Club.—Hon. Secretary, Mr. H. P. A. Suther; Chief Instructor, Major W. Jones; Ground Engineer, Mr. D. M. Langford.

Kathiawar Flying Club.—Hon. Secretary, Mr. M. D. Mehta; Chief Instructor, Mr. T. H. Dastur; Ground Engineer, Mr. E. P. Hessey; Telegrams, Katfly, Ahmedabad.

Madras Flying Club.—Hon. Secretary, Mr. G. H. Hodgson; Chief Instructor, Mr. L. H. Mason; Asst. Instructor, Mr. H. L. Tyndale-Biscoe; Ground Engineer, Mr. M. W. Hullcoop; Telegrams, Madfly, St. Thomas Mount.

Northern India Flying Club.—Hon. Secretary, Lala Rup Chand; Chief Instructor, Flt. Lt. H. W. Raeburn; Ground Engineer, Mr. P. D. Wright; Telegrams, Sunfly, Lahore.

United Provinces Flying Club.—General Hon. Secretary and Chief Instructor, Capt. B. S. Leete, A.F.C.; Ground Engineer, Mr. J. L. Castel.

Cawnpore Branch.—Hon. Secretary, Mr. T. I. Smith; Telegrams, Cawflight, Cawnpore.

Lucknow Branch.—Hon. Secretary, Mr. D. G. O'Connell, 4th Hussars; Telegrams, Lucflight, Lucknow.

THE ROYAL AERO CLUB

OFFICIAL NOTICES

ANNUAL GENERAL MEETING

THE Annual General Meeting of the Members of the Royal Aero Club of the United Kingdom will be held at 119, Piccadilly, London, W.1, on Wednesday, March 28, 1934, at 6 p.m.

Notices of motion for the Annual General Meeting must be received by the Secretary not less than 21 days before the meeting and must be signed by at least five members.

Election Committee.—In accordance with the rules, the Club shall be governed by a Committee of 18 members. Members shall be elected to serve for two years, half the Committee retiring annually. The retiring Members of the Committee are:—Capt. H. S. Broad; W. Lindsay Everard, M.P.; Col. F. Lindsay Lloyd, C.M.G., C.B.E.; Lt. Col. M. O'Gorman, C.B.; Maj. H. A. Petre, D.S.O., M.C.; Maj. A. Goodfellow; Maj. C. J. W. Darwin, D.S.O.

Retiring Members are eligible for re-election. Col. F. Lindsay Lloyd does not offer himself for re-election.

Nominations of Candidates.—Nominations of Candidates for election to the Committee must be received by the Secretary not less than 14 days before the Annual General Meeting, with an intimation in writing that the Members nominated are willing to serve. Nominations of Candidates shall be signed by at least two Members proposing them.

HAROLD E. PERRIN,
Secretary.

Offices: THE ROYAL AERO CLUB,
119, PICCADILLY, LONDON, W.1.
H. E. PERRIN, Secretary.

The AIRCRAFT ENGINEER

"FLIGHT" ENGINEERING SECTION

Edited by C. M. POULSEN

No. 97 (Volume IX No. 2) 9th Year February 22, 1934

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ENGINE COWLING

By J. D. North, F.R.Ae.S., M.I.Ae.E.

In Flight *of February 8, 1934, we published a summary of the first part of the paper under above title which Mr. J. D. North, Chief Engineer of Boulton & Paul, Ltd., read before the Royal Aeronautical Society on February 1. A brief report of the discussion was published in* Flight *last week. Below we publish extracts from the concluding part of Mr. North's very interesting paper. It should be pointed out that we have retained Mr. North's numbering of the illustrations, which has resulted in certain cases in gaps in the numbering.*—Ed.

The Townend Ring

Inasmuch as my company have proprietary interests in the patents covering the Townend Ring, and have devoted much attention to the development of this device, I am naturally in a position to give more detailed information concerning this particular form of low-drag cowling. I hope that these details will be of general interest.

Although the Townend Ring itself is a simple device, the factors which may influence its performance are many and various, and time will permit only a very general consideration of some of the more important of these factors.

Ring Sections

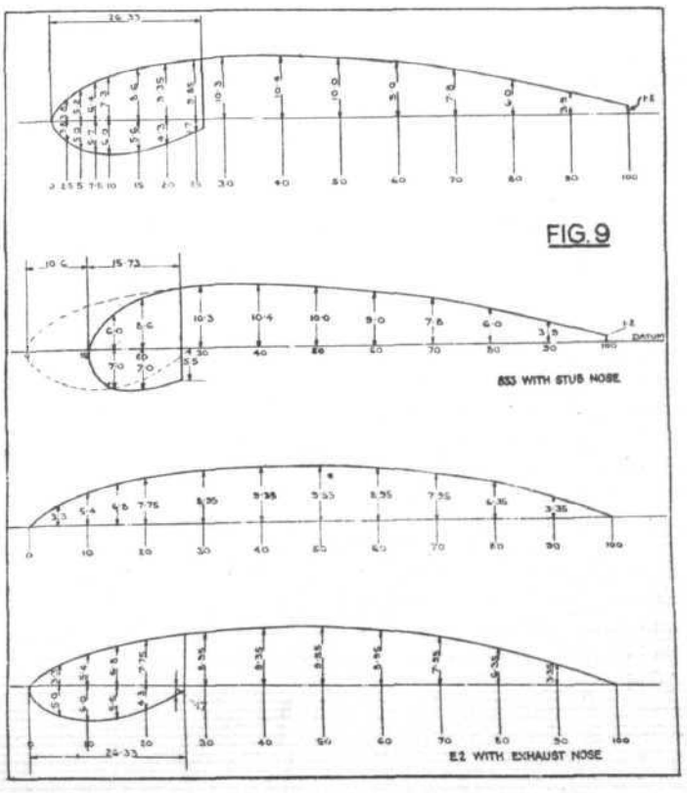
The section of a Townend Ring is an aerofoil section in so far as it is required to produce a radial outwardly directed lift with its consequent downwash. The effectiveness of a ring for given conditions is determined by the intensity of downwash per unit of circumference. Hence it is an advantage to use a section which develops a high lift coefficient in order that the chord length required may be a minimum.

Experience shows that for rings of the usual single-surfaced (plate) type a camber of about 10 per cent. of the chord length should be used. Double-surfaced sections, usually employed for wings, of the same camber on their upper surface, are less effective than the plain plate type, presumably because the mean curvature is reduced to one midway between that of upper and lower surfaces. There is some evidence that an increase of camber to more than 10 per cent. may be advantageous under certain conditions.

The addition to a plate type ring of a bulbous nose similar in form to the leading edge of a moderately thick aerofoil section has been found usually to decrease the drag of the complete ring installation quite appreciably. Such a bulbous nose has been used by Boulton & Paul as an exhaust collector and provides a method of cooling and silencing the exhaust with no increase, and normally a decrease, in total resistance. Fig. 9 shows ring sections which have satisfactorily been used for Townend Rings.

Angle of Ring Chord

The best angle between the chord line of the ring section and the thrust axis depends on many factors, such as the exact form of the engine, of the body behind the engine, of the section actually used for the ring itself and the relative fore and aft position of the ring relative to the engine. As a very rough guide,



useful for determining the range within which experiment may usefully be conducted, the lines of the body may be extra-polated forward past the engine to complete a reasonable streamline, and the chord of the ring should then be set at an angle between parallel to a tangent to, and at about 4 deg., converging rearwardly to that tangent, the tangent being taken in a plane corresponding to 50 per cent. of the chord length.

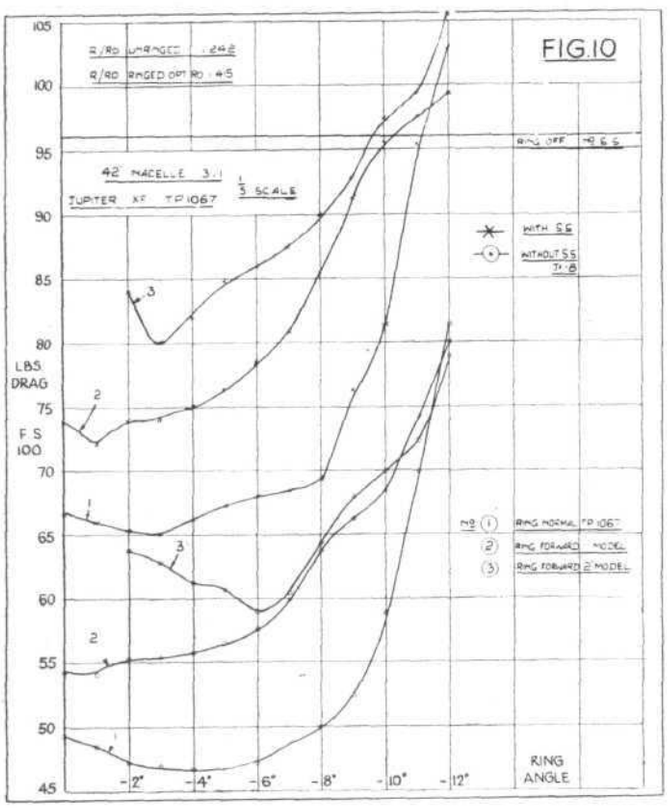


Fig. 10 shows the variation in drag of an engine and streamline nacelle fitted with a Townend Ring for various chord angles of the ring itself. The curves marked 1 relate to the ring when the midpoint of the chord lies in the plane of the cylinder centre line. Curves 2 and 3 relate to the same Townend Ring moved forward by successive steps each of about 20 per cent. of the chord length, this chord length in the particular case being about 48 per cent. of the engine diameter. For the position 1 it will be seen that there is a range of chord angle from −2 deg. to −6 deg. over which the drag is practically constant, and that at −8 deg. the drag starts to rise very rapidly. For positions 2 and 3 the minimum drag has increased appreciably and the flat portion of the curve has disappeared, No. 3 showing a sharply marked minimum value of drag, the curve rising steeply on either side of this minimum.

The general characteristics shown for the lower set of curves without slipstream are retained by the upper set which represents the conditions with an appropriate airscrew running at conditions corresponding roughly to climbing airspeed. With very few exceptions, it has been found that the presence of slipstream does not affect the relative merits of different ring arrangements.

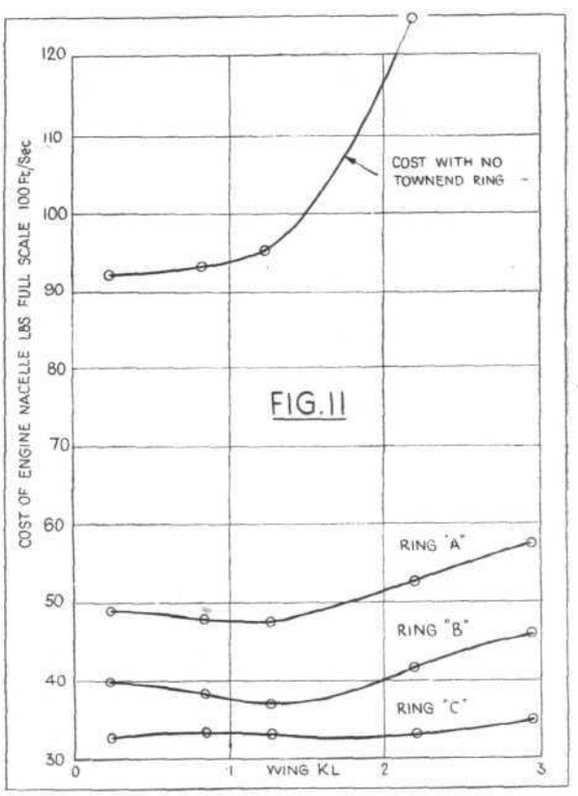
Fore and Aft Position of Ring

The curves of Fig. 10 also indicate the nature of the effect of changing fore and aft position of a Townend Ring relatively to the body. The results relate only to one particular type of ring used on a particular form of body, and even for that case do not extend sufficiently far to prove that position 1 is the best possible. Experience, however, indicates that in nearly every case a ring which is placed with its chord extending equally ahead of and behind the cylinder centre lines will give better results than one placed in any widely different position.

Chord Length

The chord length required to produce a given degree of constraint on the tendency of the airflow behind the engine to break away from the body depends mainly on the lift coefficient which is developed by the ring section. Sections of the types previously illustrated which have been found satisfactory apparently develop when used as Townend Rings lift coefficients of the order of 0.5 to 0.6, and with these sections a chord length of approximately 0.5 of the engine diameter is found to give the maximum reduction in drag.

The flow over the nose of a body engine combination is necessarily curved and change in chord length of a ring alters the effective angle of incidence between the ring and the airflow, therefore the effect of change of chord is not a simple effect. Fig. 11 shows the measured drag of a nacelle and the engine mounted on a wing when fitted with three different rings. (*a*) is a ring having a chord of approximately 0.33 engine diameter, (*b*) is a very similar ring with a chord length of 0.52 engine diameter, while (*c*) has a slightly increased chord 0.525 engine diameter and is fitted with a bulbous nose exhaust collector. The difference between (*b*) and (*c*) has little to do with chord length, but that between (*a*) and (*b*) indicates the kind of difference which attends on change of chord length.



This figure shows also the increase in drag due to the engine nacelle when no ring is fitted, and it will be seen that with no ring this drag increases very rapidly with increasing wing lift. With any of the rings this increase in cost of engine as wing lift increases is very greatly reduced and within the range covered by the figures has completed disappeared for the best of the three rings, *i.e.*, (*c*). It may be remarked that it is a general characteristic of a good Townend Ring that it maintains its effectiveness over a considerable range of conditions.

Polygonal "Rings"

Fig. 12 shows two Townend Rings of identical section, chord length, and chord angle, made for use with the same nine-cylinder engine. Tested on a streamline nacelle, the measured drag using the polygonal ring was

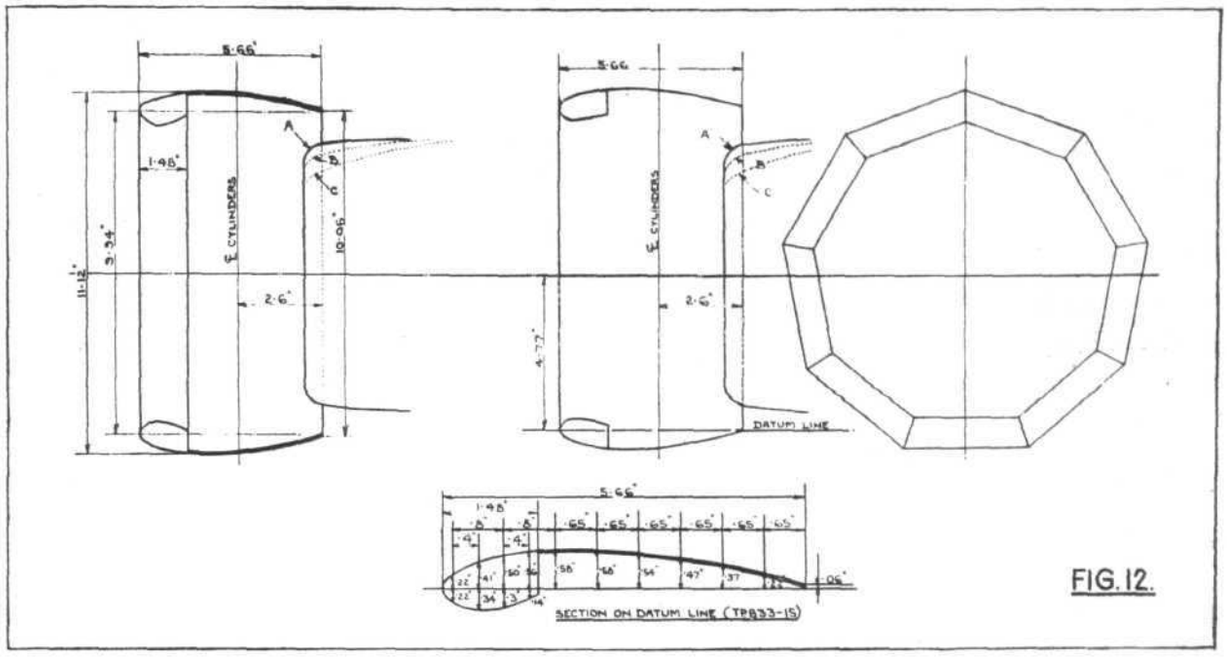


FIG. 12.

found to be slightly less than that with the circular ring. For a nine-cylinder engine 54 in. in overall diameter, the equivalent full-scale drags were 27 lb. for the polygon and 31 lb. for the circular ring, which is to be compared with 96 lb. with no Townend Ring, at an airspeed of 100 ft./sec. A very large number of tests have now been made in our wind channel giving a direct comparison between the performance of circular and polygonal rings of otherwise identical form and used on identical engine-body combinations. In no such case has the polygonal ring given results inferior to the circular one, and in the majority of cases the polygon has shown a definite advantage. Tests made with the airscrew running show that slipstream does not adversely affect the superiority of the polygon.

Body Shapes

So many practical considerations govern the design of body shapes that it is quite impossible to give any hard-and-fast rules as to the shape of body which should be employed with the Townend Ring. Fortunately, however, the performance of the Townend Ring itself appears to be influenced mainly by the form of the body for a short distance behind the ring only. Experience to date shows that for current type of radial engines the maximum reduction in drag with a Townend Ring can be secured if the body immediately behind the engine has a diameter of about 0.75 of the engine diameter and if the body lines over a distance of about one engine diameter behind the engine plate are reasonably fair and do not diverge or converge with abnormal rapidity. What the body form further from the engine may be may greatly affect the total resistance of the body and engine combination, but will not greatly affect the saving in drag caused by the Townend Ring.

Fig. 13 shows three models of engines and nacelles which have been tested. The nacelles themselves are solids of revolution having the outline of the standard 3:1 streamline strut section and differ only in the position of the engine on the bodies relative to the maximum ordinate of the basic streamline. The diameter of this maximum ordinate was 0.78 of the maximum diameter of the engine. Of the three models tested the intermediate is slightly the best, both with and without the Townend Ring, but the differences between

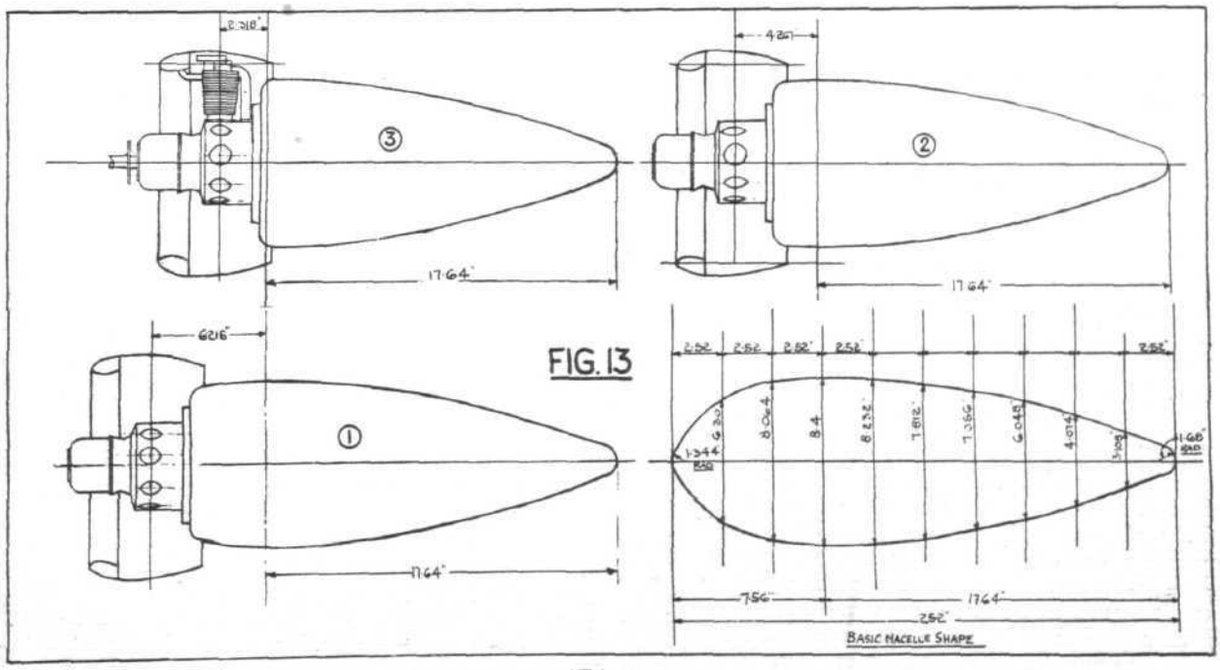


FIG. 13.

the three arrangements are not large. This intermediate arrangement is that which, with the polygonal ring, gave a total full-scale drag for the 54-in. diameter radial engine of 27 lb. at 100 ft./sec., which is so far about the minimum resistance which it has been found possible to obtain for a radial engine of these dimensions with any form of Townend Ring.

Although the tests relate directly to engines mounted on streamline nacelles in free air, experience shows that if the form of body immediately behind the engine corresponds reasonably closely to that of any of the three nacelles shown over a length equal to the engine diameter, the drag reduction caused by a given Townend Ring will be of the same order as that which the same ring would cause on the streamline nacelle. Normally for best results the body section over the region above mentioned should be circular. If a polygon ring is used, a polygon body, sides parallel to those of the ring, is as good as, or slightly better than, a circular one.

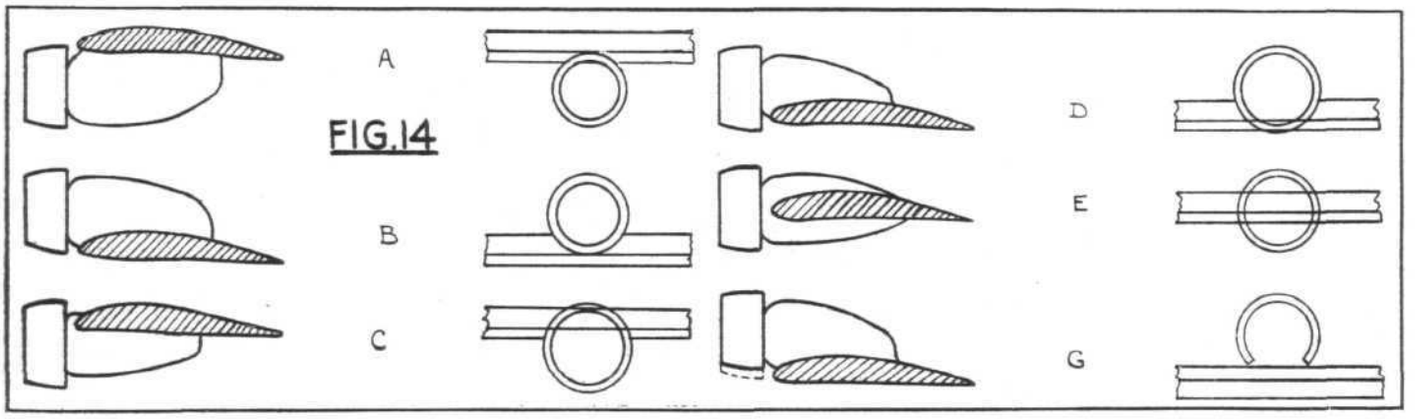


FIG. 14

Townend Rings and Interference

The effect of the Townend Ring on the drag of an engine is of the type of phenomenon usually described as "interference." Fig. 11 already shown indicates clearly how a Townend Ring may reduce interference between a wing engine installation and the wing itself, and in cases where, as is usual, such wing engine interference is appreciable, a satisfactory Townend Ring will almost invariably greatly reduce the interference drag.

The Townend Ring itself is very sensitive to certain types of interference. If the flow over the outer surface of the ring is disturbed, it may be caused to break away and local stalling of the ring section provoked. More than a very limited degree of such local disturbance is found to produce an effect which spreads round the ring circumference and very rapidly destroys the effectiveness of the ring. The most difficult cases of interference with the Townend Ring yet encountered are those in which interference between the ring and a closely approaching wing occur.

Fig. 14 shows at (*a*) and (*b*) conditions which almost inevitably lead to serious interference of this type and should be avoided; (*c*) and (*d*), which differ from (*a*) and (*b*) only in a relative vertical displacement of ring and wing so that the leading edge of the wing definitely cuts the ring periphery instead of being nearly tangent to it, are free from this trouble and give satisfactory results. A variant of (*a*) in which the engine is dropped below the wing and the nacelle is separated therefrom instead of being built on to it may be worse than (*a*) itself, and is only satisfactory when the engine is dropped far enough to give a large vertical gap between the ring and the leading edge of the wing. The arrangement (*e*) gives excellent results, but it is important not to move the ring and engine so far back that the leading edge must be mutilated to clear the engine itself.

(*g*) in this figure shows a case where interference between wing and ring was greatly reduced by cutting away a segment of the ring in way of the wing. Generally speaking, cutting of gaps in the ring circumference causes the ring to become almost completely ineffective. If, however, a member is provided which will serve to carry the general ring circulation across the gap, the effect of the interruption becomes unimportant. The case illustrated is one in which the wing serves to bridge the gap.

The total resistance of a ring-cowled installation is very little affected by bodies which are within the wing itself. Circular struts for supporting the ring do not increase the drag as compared to streamline struts. Exhaust collectors within the ring have but a very small effect, which is often unmeasurable, and the effect of fitting inter-cylinder baffles, various types of air intakes, or the like, which do not protrude beyond the ring is invariably small, and usually negligible.

Engine Cooling

Comparison of a typical Townend Ring with any other form of low drag cowling for use on a similar engine indicates the probability that the ring will interfere less with cooling than will any of its present-day competitors. The necessary development of a lift force by the ring sections and the circulation round the ring which this implies, involves some reduction in the velocity through the ring as compared to that outside it. This reduction in velocity cannot be of any great magnitude and would not be expected to account for any serious effect on cooling.

Practical experience has shown that the Townend Ring does give cooling superior to that of other available types of cowling for radial engines capable of substantially reducing the drag of those engines. Mr. Fedden has published results which show that satisfactory cooling can be obtained with a Townend Ring on a particular engine and aircraft combination to which the application of a complete cowling of the N.A.C.A. type was impracticable because it caused overheating. There is a considerable fund of experience in America indicating that whereas this complete type of cowling can normally be employed successfully on ungeared engines, it leads frequently to difficulties with cooling when it is applied to geared and particularly to geared and supercharged engines. The restricted frontal opening of the complete N.A.C.A. cowling is in the region mainly affected by airscrew boss shielding, and the area so affected is greatly increased, as has already been pointed out, when a large diameter slow running airscrew is employed. The Townend Ring, with its wider frontal aperture, is less affected in this way.

Direct measurements of the air velocity close to the sparking plugs of a nine-cylinder radial engine have been made in flight (Ref. B. and P. tests 2161 and 2173), both with and without Townend Ring, using

pitot heads and hot wire anemometers. The pitot heads show a small rise in velocity of the order of 5 per cent. when the ring was fitted, the hot wire anemometer, on the other hand, showed a reduction of the same order. Many explanations for this discrepancy are possible, the most probable being that the Townend Ring had substantially changed the direction of air flow, to which the hot wire anemometer would be insensitive. The hot wire anemometer being a direct method of measuring cooling and only an indirect measure of air speed, the results indicate a small loss in effective cooling.

Fig. 16 shows temperatures measured on the rear face of the cylinder heads of a nine-cylinder radial engine

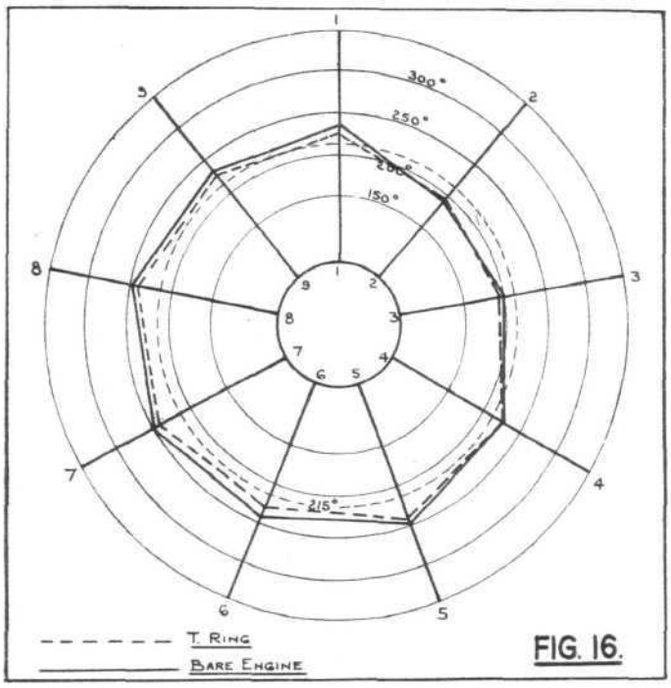


FIG. 16.

running on the test bed with the standard fan and wind tunnel cooling arrangement. Two curves, which are very nearly identical, relate to the temperatures with and without a Townend Ring. The absence of any appreciable difference in temperature under the two conditions may be explained by the artificial cooling conditions. Attention is directed, however, to the irregularity of temperature distribution round the engines, the maximum variation between individual cylinder temperatures being about 50 deg. C.

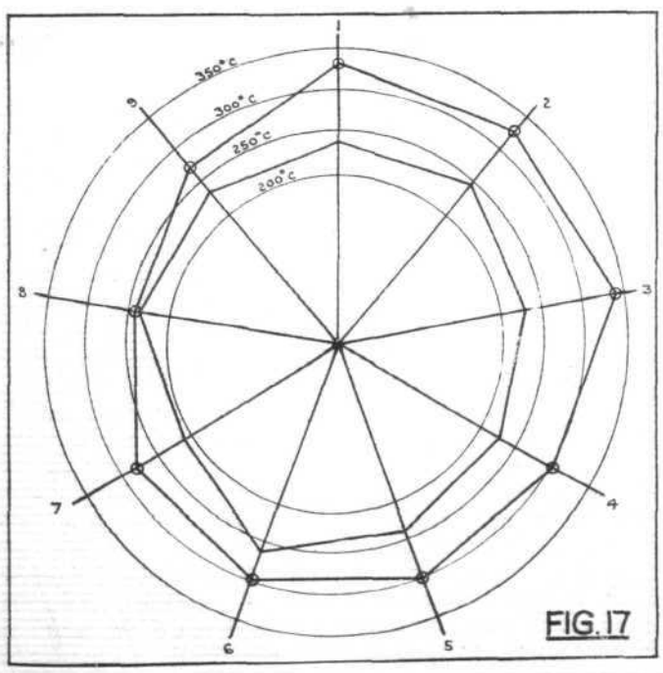


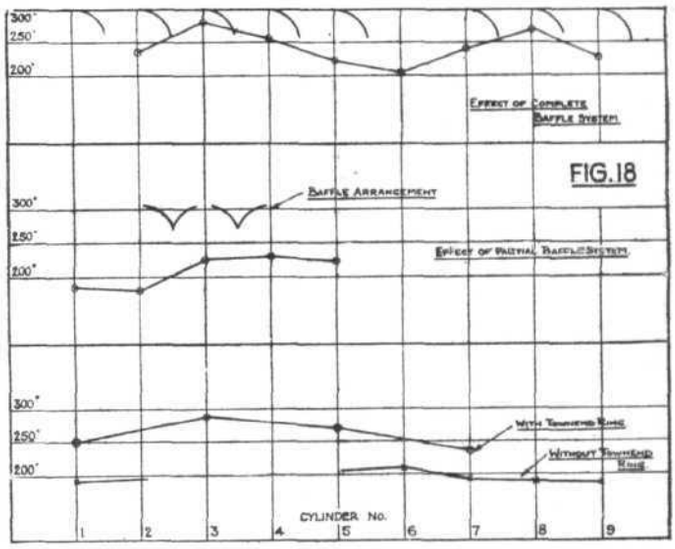
FIG. 17

Fig. 17 shows cylinder temperatures measured on an engine of the same type during climb, with and without Townend Rings on the same aircraft.

The average temperature when the Townend Ring is fitted has obviously increased appreciably. The irregularity of temperature distribution around the engine is more marked both with and without ring than is shown in the test-bed case. Repeated tests under similar conditions, using the same engines and aircraft, have shown that this irregularity, though always present, varied from flight to flight, and it was quite usual to find that a cylinder which had developed an abnormally high temperature on one flight remained abnormally cool on the next.

Fig. 17 relates to a type of engine which had had its power output boosted to about the limit of its cooling capacity when used without a Townend Ring, and even in this condition at the relatively slow climbing speed used in this particular case the cooling could not be regarded as completely satisfactory.

Fig. 18 shows in a slightly different form the results of similar tests on an engine of generally similar type. In the bottom curves the temperature of No. 3 cylinder with the Townend Ring is definitely unsatisfactory. Tests were accordingly made with inter-cylinder baffles around cylinder No. 3, which also half encircled cylinders



Nos. 2 and 4. As the second set of curves show, the temperature of No. 3 cylinder dropped from 285 deg. C. to 225 deg. C. No. 2 cylinder only half baffled showed practically the same temperature as No. 3 with the complete baffling. It may be noted that No. 1, complete unbaffled, dropped in temperature between the two tests by nearly 70 deg. and No. 5, also unbaffled, by 50 deg. C. Following this test all cylinders except No. 6 were fitted with half baffles of the type which had apparently effectively cooled No. 2. On a third test, indicated by the upper curve, the temperature of No. 3 had returned to practically its original high figure, and it will be obvious that no sort of connection can be established between the presence of baffles and cylinder temperatures. Further, the irregularity of temperatures round the engine is very obvious, and is found to a less degree even where cooling is considered satisfactory. Wherever the fitting of Townend Rings has led to actual overheating, investigation indicates that this irregularity of cylinder temperatures becomes very marked indeed.

Increase in general temperature marked by such violent irregularities in temperature distribution can obviously scarcely be attributed to any direct effect of the Townend Ring on the effective cooling velocity over the engine, and many explanations of the effect have been considered. Of these, the one which seems to have the best foundation is that the very considerable change

in the direction and general turbulence of the airflow past the engine caused by the ring may disturb air intake and carburetter conditions and lead to variations in mixture strength and/or to irregular gas distribution.

Serious cooling difficulties attendant upon the fitting of the Townend Ring rarely arise, except in the rapidly-diminishing number of cases in which the cooling margin of the engine, even without low-drag cowling, is small. The designer of radial engines has realised the importance of modern low-drag cowlings and of providing his engines with cooling capacity which will be adequate when such cowlings are fitted, consequently such difficulties are steadily growing rarer.

Where irregular temperature distribution occurs, and there is strong evidence that it occurs to some extent in all air-cooled engines, the cooling which has to be provided is that which will keep the hottest cylinder down to permissible limits; and the analysis of the reasons for such irregular temperatures and methods for their cure should be of the utimost interest to the engine maker himself, since they are one method by which effective cooling can be appreciably increased.

(To be concluded.)

ETHYL

BY F. R. BANKS, O.B.E., F.R.AE.S., M.I.A.E., M.INST.P.T., M.S.A.E.

(Concluded from p. 4.)

General Notes on Engine Operation with Leaded Fuels

THE internal appearance of an engine which has run on a fuel containing lead differs somewhat from that usually associated with the more ordinary fuels. The deposit from the use of the former fuel is harder in nature and perhaps more adherent than that of the latter. Its colouration is also different, being white to greyish white on the cooler parts of the combustion chamber and reddish brown on the hotter parts. This is due to the presence of lead bromide. There is, sometimes a yellowish tinge to the deposit, which may be accounted for by some lead sulphate present in the deposit. Where a part, such as an exhaust valve, has been running unduly hot, the deposit is generally exceedingly adherent to the valve head and has a dark "steel" grey appearance. The dye which is present in all leaded fuels is particularly useful for the relatively complicated fuel systems used in aviation engine installations, since it shows up, almost immediately, any leaks which may be present.

Some queries have arisen regarding the effect of leaded fuels on the materials used for aircraft fuel tanks. No trouble has been experienced in the case of tanks manufactured from the usual aluminium alloys, but with regard to those particular alloys which contain a large percentage of magnesium, such as Elektron, there seems to be some doubt as to the advisability of employing them for fuel tanks at all.

One's personal experience is that corrosion trouble is manifest with high magnesium alloys when water is present in the fuel, whether the latter contains lead or not. If it contains lead, then the corrosion attack appears to be somewhat accelerated. From this one deduces that the presence of water is really the deciding factor, but it is almost impossible to avoid a certain amount of water collecting in fuel tanks. It is suggested, however, that magnesium alloy tanks could be designed with provision for a sump of some material which does not suffer from this corrosion attack, such as pure aluminium, etc. The sump would be deep enough to prevent any water reaching the joint between it and the tank, in order to avoid the possibility of electrolytic action.

Engine Tests and the Influence of Increasing Concentrations of Lead

When considering the duration of engine tests in order to ascertain the effect of leaded fuel upon the engine parts, one is of the opinion that no tests of less than 100 hours' duration are of value.

In order to promote rapid engine development on leaded fuels, the knock rating of the finished fuel should be decided upon in the first place, after which a basic petrol chosen, having an initial anti-knock value which demands a fairly large amount of lead in order to attain the required final value. This will ensure that the engine is capable of giving satisfactory operation with any concentration met with in service, even although it may eventually be provided with a fuel, the basis of which only requires a very small amount of lead in order to reach the desired anti-knock value.

There are many contentions regarding the influence of increasing lead concentrations on engine condition, and in general the consensus of opinion appears to be that an increase in lead concentration gives the engine parts concerned a harder time by increasing the rate of deposition of the products of combustion. One is not substantially at variance with this view, and has always maintained that tests should be carried out on the lines suggested in the previous paragraphs of this section. It is quite feasible to suppose that an increase in the amount of lead must generally show up in the form of greater rate of deposit build up. However, the following points are put forward as a matter of interest.

Firstly, the American view, backed by six or eight years of intensive experiment and use of leaded fuels, is that increasing concentrations of lead tend to increase the rate of attack and deposit build up, which may lead to troubles previously dormant.

Secondly, tests have been carried out by the Air Ministry, at the works of the aviation engine firms in this country, over the last two years. The tests, of 100 hours' duration, were made on representative types of engines in service, and the results did not completely bear out American experience.

The interesting point about these tests is that valve failure, due to burning, was experienced in some cases and occurred in about 50 to 70 hours of running. Further tests of 100 hours' duration were then made after completely reconditioning the engines concerned, but a fuel having only 1 c.c. of lead per gallon was tried, where previously a "4 c.c." concentration was employed. The same class of petrol was used as the basis of the fuels, and a similar knock rating to the "4 c.c." fuel was obtained by the use of added aromatics. However, in a directly comparative test with this and the "4 c.c." fuel, precisely the same degree of valve failure in practically similar periods was experienced with both fuels. Therefore, from the experience in this country and in Europe, one would say that increasing lead concentrations do not necessarily give rise to trouble or to the same ratio increase of deposits in the engine.

With regard to the apparent variation between the results obtained here and in Europe, to those indicated by American experience, a satisfactory explanation might be that the modern American engine has been developed over the same period as that of leaded fuels; consequently a certain amount of technique has been evolved to deal particularly with their use. A great deal more flying, with engines using such fuels, has also been done in America, while little or none has been done in this country, and practically all our leaded

fuel development has been restricted to relatively severe experimental running and type tests which, one submits, are more critical than flight conditions. One is of the opinion that any troubles experienced in America with leaded fuels of high concentration are not so much due to this feature, but rather to the increased "power per litre" of cylinder capacity at which American engines are now running under normal cruising conditions in flight.

Knock Testing and Assessing Fuels in Relation to Engine Performance

The question of testing fuels for anti-knock value is, admittedly, a subject in itself and hardly comes within the scope of this paper, but it has such direct bearing upon the successful development and satisfactory operation of aviation engines that perhaps little excuse is needed to mention it.

The whole essence of knock-testing technique is the ability to correlate the results obtained on the fuel-testing unit, with the performance of the fuels in the engine and to be able to assess the knock ratings of the various fuels in their order of merit. It is exceedingly difficult to arrange a complete set of conditions for the fuel-testing unit which will imitate, accurately, those met with in the engine. Some time ago, the Institution of Petroleum Technologists appointed a sub-committee to formulate a suitable programme in order that experiments could be carried out and the data obtained therefrom used to enable a satisfactory technique to be evolved for the correlation of laboratory knock test results with actual engine performance. Tribute should be paid to the I.P.T., which is the first body to formulate a method of knock testing and correlating aviation fuels, to be accepted nationally. This should, however, only be regarded as a preliminary step. These test results are very clearly and completely described by Mr. Pye, who was chairman of the sub-committee, in a paper read before the World Petroleum Congress last year.

The running tests were carried out at the R.A.E., Farnborough, on air- and water-cooled units, and at the engine works of the Bristol Aeroplane Co. Single-cylinder units of representative service engines were used, and in no case was a complete engine employed. Due, according to the report, to the "extreme difficulty of accurately detecting the onset of detonation in a complete aero engine and to the large quantity of expensive sub-standard fuel which would be required."

One contends that, outside the expense, and particularly in the case of the air-cooled engine, the question of audible detonation is not necessarily important, but that the temperature effect on the cylinder head, due to the detonative characteristics of the particular fuel used, is more a measure of that fuel's ability to operate satisfactorily in the engine.

With these large engines of comparatively high specific power output, a fuel can cause a dangerous rise in the operating temperature of the cylinder head, which on further increase will result in pre-ignition rather than detonation. This is markedly so when the non-knocking fuels are used. This is largely the reason why all the recent fuel tests formulated by the U.S. Army Air Corps specify that the sample tested shall not show a higher reading of the temperature plug than the reference fuel; rather than taking average bouncing pin readings.

One would say that one or two fuel tests carried out on a complete engine, particularly of the air-cooled type, heavily thermocoupled at suitable points, would have yielded more valuable information than the single-cylinder tests. A further important point is that the tests at Farnborough were run at varying speeds, whereas general experience would indicate that constant speed is necessary when matching fuels.

The report also gives an explanation for the test methods finally adopted as a result of the work done, *i.e.*, C.F.R. Motor Method, modified to use a mixture temperature of 260 deg. F., instead of 300 deg. F., and why the method is less severe than that employed for correlating automobile fuels (Motor Method). The explanation offered is: "that when a read vehicle engine in pulling at low speed on full throttle the conditions are not only severe by reason of the low speed, but that in many types there is also provision for a large amount of mixture heating which may vary and exceed even the heating provided by a supercharger."

A road vehicle engine is certainly severe on the fuel under the conditions described, but it must be remembered that the B.M.E.P. and mean temperatures, when compared with those of an aviation engine, are not so high, and also, the cylinders are not so large with, generally, a greater ratio of surface to volume than the aviation engine.

Consequently, audible knock may be severe for the comparatively short time that the vehicle is running under these conditions, but due to the inherent design of the automobile engine it will take a considerable time before detonation becomes great enough to build up excessive heat and/or bring about actual damage, although, admittedly, the performance of the engine, and consequently the vehicle, is impaired. It is not easy to see how these conditions can be more severe than, say, those of an air-cooled engine having large cylinders by comparison and running at full rated load in an aircraft under climbing conditions, where the rate of air flow over the cylinders is at a minimum and as altitude is increased, with a corresponding decrease in air density, the difficulty of dissipating heat from the cylinders is greater.

Actually, the operating speed of an automobile engine, under which detonation usually occurs, is not always so low as might at first be supposed, when compared with the normal speed of an aviation engine, although it may be lower in proportion to the maximum speed in the former case. In fact, the C.F.R. road tests showed that maximum knock occurred at road speeds varying from about 15 to 40 m.p.h. corresponding to crankshaft speeds of approximately 900 to 2,500 r.p.m. respectively. The contentions put forward here are not in any way intended as a criticism of the *accuracy* of the I.P.T. investigation, since the results of the tests have proved their own accuracy and have shown that it is possible to obtain good correlation with a given set of engine conditions.

Criticism might be made that the engine conditions specified did not accurately represent those met with in actual service, and in addition only fuels of comparatively moderate knock ratings were tested, whereas, for future engine development, the Air Ministry has already brought out a fuel specification, D.T.D. 230, in which an Octane value of 87 is called for when tested under the modified Motor Method and, also, the use of lead is allowed. None of the fuels in the I.P.T. tests contained lead. This fuel will be used for new types and these engines will undoubtedly produce higher specific power outputs than the previous models, upon which the I.P.T. investigation was made, and will probably give the fuel a harder time in comparison.

It remains to be seen therefore, whether the correlation as carried out, applies in this particular case. Some correlation tests on complete engines are already in progress in America, and it will be interesting to study the results and learn the conclusions arrived at, when they are published.

The latest fuel specification (No. Y-3557-G) evolved by the U.S. Army Air Corps, calls for a nominal Octane value of 92. A C.F.R. engine is used as the basis, but is considerably modified to conform to Air Corps requirements. The temperature rise method of assessing the anti-detonation value is retained. The engine speed of

the unit has been increased to 1,200 r.p.m. and a jacket temperature of 165 deg. C. (330 deg. F.) is used.

The C.F.R. Committee, however, has tentatively adopted the C.F.R. Motor Method, unmodified, for testing aviation fuels, pending the results of the investigations now being made. The work of the C.F.R. Committee must not be confused with that of the U.S. Army Air Corps, which latter are an entirely separate and governmental body. The C.F.R. Committee represents the oil concerns, also automobile and aviation engine interests.

Conclusion

It is submitted that a fairly comprehensive exposition of the leaded fuel situation was needed in view of the lack of comprehensive and practical information which was available to the engine manufacturers and operators. It is not too much to say that air supremacy, whether considered from the civil or military standpoint, will eventually go to the nation which develops engines making the fullest use of fuels of really high anti-knock value.

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

AN APPLICATION OF PRANDTL THEORY TO AN AIRSCREW. By C. N. H. Lock, M.A. R. & M. No. 1521. (41 pages and 13 diagrams.) August 30, 1932. Price 2s. 3d. net.

The velocity field of the helical trailing vortices of an airscrew is obtained on the basis of Prandtl's artifice of replacing the helical vortex sheets by plane vortex sheets, thus reducing the problem to one of two-dimensional flow of a perfect fluid. Prandtl's original treatment was confined to the special case in which the trailing vortex sheets are equivalent to rigid laminæ (the airscrew with minimum energy loss); the present paper solves the problem for a general distribution of vorticity with radius by means of a Fourier expansion, the method being analogous to that used by Trefftz for the monoplane aerofoil.

In its simplest form the method neglects squares and higher powers of the blade incidence and is subject to errors arising from the replacement of helical vortices by straight vortices; these limitations are afterwards removed by various artifices which, although they do not represent a rigorous solution of the problem, should give results which are sufficiently accurate in all practical cases.

The method is compared (*a*) with the result of assuming the number of blades to be infinite (Vortex theory) and (*b*) with the result of determining the performance of each blade element separately on the assumption that the rest of the wake has the special distribution (minimum energy loss) for which the numerical solution was given by Goldstein (approximate Goldstein method of R. & M. 1377). Numerical comparisons are confined to the case of an airscrew of constant pitch with "square tipped" blades.

A formula for an approximate overall correction, given by Prandtl, to results calculated by method (*a*) is discussed and it is shown that if the formula is applied to calculations for an infinite number of blades with square tips (as in Glauert's "Airscrews for high speed aeroplanes"*) the corrected values will apply approximately to two- and four-bladers of normal plan form. Alternative formulæ are given which can be used to convert from an infinite number of blades of normal plan form to two- and four-bladers of the same plan form.

* R. & M. 1342.

ABSTRACT.

THE FLOW PAST CIRCULAR CYLINDERS AT LOW SPEEDS. By A. Thom, D.Sc., Ph.D. R. & M. No. 1539. (2 pages and 3 diagrams.) June, 1932. Price 3d. net.

Abstract only of paper published in Royal Society Proc.

ABSTRACT.

THE CONVECTION OF HEAT FROM ISOLATED PLATES AND CYLINDERS IN AN INVISCID STREAM. By N. A. V. Piercy, D.Sc., and H. F. Winny, Ph.D. R. & M. No. 1540. (2 pages.) September 22, 1932. Price 2d. net.

Abstract only of paper published in the *Phil. Mag*

THE RADIALLY-BRACED AIRSHIP RING. By Prof. L. Bairstow, C.B.E., F.R.S. Communicated by D.S.R., Air Ministry. R. & M. No. 1551. (28 pages and 12 diagrams.) March 22, 1933.

The investigation represents an attempt to reduce the considerable labour involved in computing the stresses in the rings of rigid airships. The analysis is developed in terms of the radially-braced ring, but gives the essentials for an unbraced ring. The account is divisible into three sections:—

Section 1.—It is shown that calculations of stresses, etc., in a symmetrical ring, loaded in any possible way in its own plane may be made to depend on the addition of results of calculations for two simple standard types. The considerable reduction of labour which follows for all calculations save the first is independent of the particular system of stress analysis adopted.

Section 2.—An approximate solution to reduce the labour connected with the standard types; it is probable that the approximation could be carried further, if desired.

Section 3.—An illustration of the use of Sections 1 and 2 in the case of an airship ring. The illustration deals with the problems which arise when wires become slack under load.

SUMMARY OF THE PRESENT STATE OF KNOWLEDGE REGARDING SHEET-METAL CONSTRUCTION. By H. L. Cox, B.A. R. & M. No. 1553. (20 pages.) August 3, 1933. Price 1s. net.

Investigation into the strength of constructions in thin sheet metal divides itself naturally into two parts, firstly, consideration of the phenomenon of buckling and the determination of buckling load; secondly, the investigation of conditions after buckling has commenced. In the majority of aircraft constructions, buckling will normally occur at so low a load that the occurrence of buckling will not in itself be of great importance. Nevertheless there are important exceptions to this statement, of which built-up spars and constructions in corrugated sheet may be cited.

In this summary attention is mainly confined to the effect of buckling under shear *or* under uniaxial compressive loading. The problem of buckling under *combined shear and compressive* loading has not been considered by any investigator.

THE EFFECT OF AILERONS ON THE SPINNING OF A BRISTOL FIGHTER AEROPLANE. By A. V. Stephens, B.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1555. (7 pages and 5 diagrams.) June 10, 1933. Price 6d. net.

It has long been accepted* that ordinary ailerons, although of little value as a control for recovering from spins, may exert a large influence upon the character of the steady spin. Conventional ailerons have been found to maintain their power of producing a rolling moment (chord axes) up to large angles of incidence, but they also tend to induce a yawing couple of the opposite sign. Moreover, it has been shown theoretically† that the effects of applying a pure rolling couple against a spin, whether dynamically or otherwise, are not in general such as to accelerate recovery; and also that even a small applied yawing couple may cause a radical change in the nature of the spin. Accordingly, the influence of ailerons is in general governed by the yawing moment (chord axes) due to them.

Complete measurements of a series of spins, covering the available range of aileron movement were obtained (*a*) with the aeroplane loaded normally; (*b*) with 40 lb. of shot in each wing tip. The effect of applying aileron in either direction during the recovery from a normal spin was also investigated.

Ailerons were found to exert a large influence upon the character of the steady spin; crossing the ailerons rendered the spin flatter, whereas setting them "with" the spin had the opposite effect. The total range of incidence obtainable in this way was from 33° to 60° for the aircraft under normal load.

* "The Spinning of Aeroplanes." Gates and Bryant, October, 1926. R. & M. 1001.

† "Note on Recovery from a Spin." Bryant and Jones, October, 1930. R. & M. 1426.

HEAT TRANSMISSION THROUGH CIRCULAR, SQUARE AND RECTANGULAR PIPES. By A. Bailey, M.Sc., Assoc.M.Inst.C.E., and W. F. Cope, B.A. Work performed for the Department of Scientific and Industrial Research. R. & M. No. 1560. (11 pages and 12 diagrams.) May 24, 1933.

The present state of our knowledge of heat transmission has been summarised by M. Fishenden and O. A. Saunders,* and a study of the chapter of their book dealing with convective flow in pipes shows that although the results of many *ad hoc* researches have been published, there have been few systematic investigations of the problem. In particular, little work appears to have been done on pipes of other than circular cross section. At the suggestion of the Aerodynamics Sub-Committee of the Aeronautical Research Committee the present investigation was undertaken at the N.P.L. using an apparatus which would enable the friction and heat transmission to a stream of fluid flowing through a pipe of given cross section to be measured simultaneously over the same portion of the pipe. For simplicity, it was decided to start with water as the working fluid and to use drawn copper pipes, as these were easily obtainable in a variety of cross sections.

A technique has been worked out and apparatus constructed for the simultaneous measurement of the fluid friction and the heat transfer from either tube to fluid or fluid to tube over the central portion of a copper pipe of circular or rectangular section. Tests have been carried out on pipes having internal dimensions 1·71 cm. diameter, 1·40 cm. square, 1·90 cm. × 0·90 cm., 2·22 cm. × 0·63 cm., and 2·53 cm. × 0·32 cm. rectangles over a range of Reynolds numbers from 3,000 to 25,000.

The observations taken of both friction and heat transmission have been reduced by the method of dimensional analysis.

The following conclusions have been drawn:—

(1) That the hydraulic diameter is the correct length parameter to use in correlating heat-transmission results.

(2) That an increase in surface friction does not necessarily lead to a corresponding increase in heat transmission.

(3) That the heat transmission of a narrow rectangular pipe through which water is flowing and being heated is greater than that of a circular pipe under the same circumstances. If the water is being cooled, the heat transmission of the flat pipe is less than that of the circular pipe.

It is proposed to extend the range of the observations with water and to carry out similar tests with other fluids.

* "The Calculation of Heat Transmission." H.M.S.O. 1932.

From the Clubs

HATFIELD

The London Aeroplane Club recorded 51 hr. 15 min. flying during the week. Among new members, the Club has much pleasure in welcoming Miss Kehyaian and Mr. L. Christiansen ; the latter has come from Norway to take a "B" licence. Mr. Ross Kirkman, from Rhodesia, made his first solo flight during the week and Mr. J. G. Campbell completed his "A" licence tests. The dates of the landing competitions have been fixed ; they are Sundays, February 25, March 4 and March 11. Mr. F. H. Marusoh has taken delivery of his "Leopard Moth" and has taken advantage of all fine weather to put in a considerable amount of flying. The flying time for the R.A.F. Reserve amounted to 73 hr. 15 min., the R.A.F. Flying Club to 16 hr. 40 min. and the Stage and Screen Aero Club 2 hr. 30 min. Private owners who flew during the week-end were Lady Bailey, Sir Derwent Hall-Caine, Messrs. Whitbread and Place. Visitors to the aerodrome by air included Miss Norman, Messrs. Houston, Young, Dock, Laplin, Williams and Sir Alfred Beit in his Miles "Hawk." Squash matches have been fixed with several teams, the first taking place on February 22 against the "White Elephant" Club of Trinity Hall College, Cambridge.

The Grown Up Kids' Party on Wednesday, February 14, was a great success, and a large party was present, although sickness prevented quite a few from attending. After parking in the pram park and depositing their wraps with "nurse" in either of the boys' or girls' cloak rooms, members proceeded either to the nursery or to the dispensary, where Doctor "Will," complete in top hat and side whiskers was kept busy making up doses of cod liver oil, gripe water, poisons, etc. At dinner the menus were written on slates, and bibs were provided in place of the usual napkins. The dresses were really good, and members went to a great deal of trouble to "look the part." The girls in rompers or short frocks with socks looked most attractive. The boys also favoured rompers or very short shorts, very few having been promoted to long trousers. The dance restaurant had been hung with the large posters of Ovaltine, Glaxo, Nestlé's, Bovril, Yardley's, etc., and the kiosk converted into a doll's house, complete with stork and nest between the two chimneys. The bandstand was decorated with smaller posters, and large slates with the day's "Special" hung round the walls. An excellent cabaret show took place during the evening, the performers being Francois, acrobatic dancer, and Pat and Ivy Hyde in "Gems of Melody." The music was as usual provided by Jerry Davidson and his "Red Peppers," who worked very hard, and kept the boys and girls continually on their feet until 2 a.m.

HAMPSHIRE AEROPLANE CLUB

During the month of January 80 hr. 35 min. were flown by the four club aircraft. One new member joined the Club, Sub. Lt. P. F. N. Parker, R.N., and first solos were made by Messrs. Butler and Belton. A successful dance was held at the South Western Hotel on January 3. On January 24 a lecture was given in the lounge by Mr. K. C. Winton on "The Use of the Compass." During the first fortnight of February, 45 hr. 15 min. flying has been put in, one new member has joined, and "A" licences have been obtained by Messrs. Courtenay, Coles and Adamson. Cross-country flights have been made by members to Andover, Brooklands, Farnborough, Sywell and Bristol. On February 14 a lecture was given by Lt. M. G. Rimington, R.N., on the subject of "Submarines." On Saturday, February 24, a "When we were young" party will be held at the clubhouse.

READING AERO CLUB

In spite of the foggy weather which has been generally prevalent over the British Isles lately, Woodley has been fortunate enough to experience fairly decent weather, and 34 hr. flying has been accomplished by the machines of Phillips & Powis School of Flying. Among new members are Messrs. Craig, Watson, Knight and Clark. First solos have been made by Messrs. Fatti, Hicks and Gill. Mr. Stephen Cliff has arrived back from Egypt where he competed in the Oasis Rally. His cabin "Hawk" did some 86 hours' flying during the time it spent abroad. The Reading Aero Club Pirates' Dance produced a very warlike array of brigands, some 80 members and friends being present.

BROOKLANDS

Fog has been rather prevalent during the week, but flying was very active during the available periods. The total flying for the week amounted to 57 hr. Cross-country flights were carried out to Portsmouth, Southampton, Manston and Bristol. Two new members joined, Messrs. Gooch and Jenyns.

THE LANCASHIRE AERO CLUB

A farewell dinner was held on February 10 in honour of Mr. A. A. Pratt, who is departing from the Club. A large number turned up to give him a good send-off. Dr. A. S. Simpson obtained his "A" licence during the week.

HULL AERO CLUB

The Club had hoped that some definite news about the future would be announced this week, but unfortunately there is not yet anything to report. In the meantime the following sub-committees have been appointed. Flying: Messrs. H. W. Griffin, V. Lockey and J. E. Raddings. Social: Messrs. A. B. Croskin, T. R. Oliver and P. Bloom. Membership propaganda: Col. B. M. R. Sharp, Messrs. C. B. North and C. Halford. Lecture classes: Messrs. J. E. Raddings, V. Lockey and W. H. Carr. Mr. W. H. Carr, who has an extra master's ticket in sail and steam, is starting a much needed navigation class. The Club are indebted to Mr. Raddings for securing the Stipendiary Magistrate, one of the wittiest speakers in Hull, to lecture on "The High Court" on Thursday, March 15 ; it is hoped to secure the services of Air Commodore Chamier, the Secretary-General of the Air League. Club nights will be held on March 10 and 24. A "Spotting the Mark" flying competition will be held on Sunday, February 25. The Receiver and Manager of N.F.S. has assured the Club Secretary that in the event of N.F.S. ceasing operations at Hedon, a proportion of the subscriptions already paid will be handed over to the Club.

CARDIFF AEROPLANE CLUB

Flying times for the week totalled 3 hr. 5 min. dual, 1 hr. 40 min. solo and 35 min. tests. A new flying member is Mr. F. Booth.

HANWORTH (N.F.S.)

Flying times for the week on club machines amounted to 25 hr. 25 min. Mr. l'Estrange has joined the Club and intends to qualify for an "A" licence. On Tuesday Mr. Ramsay left Hanworth to fly to Scotland in a "Martlet."

LIVERPOOL AND DISTRICT AERO CLUB

Flying returns for week ending Friday, February 16, record 13 hr. 40 min. dual and 22 hr. 5 min. Weather conditions have been bad, chiefly through fog.

CINQUE PORTS FLYING CLUB

During the week some 20 hr. flying was put in. Mr. C. Ruscoe completed his "A" licence tests and Mr. Stewart, who has been learning on Mr. C. M. Turner's machine, made a successful first solo. Fog at Croydon has brought many air mail and passenger machines to Lympne during the week and at one time seven such machines were to be seen on the aerodrome. Com. Ben Wayatt, the American Air Attaché, was held up for two days on his way to Paris, and visited the Club. His machine, a one time U.S. Naval two-seater, is fitted with a 425-h.p. Pratt & Whitney "Wasp" engine. He left for Paris about midday on Saturday last. Mr. and Mrs. Davis are back at Lympne after a week at Brooklands and Northampton and Mr. J. G. Brown is now at Lympne learning club management ; he has just completed his course at the College of Aeronautical Engineering and will take his examination for Ground Engineer's tickets next month. Mr. R. M. Clark has successfully passed his "A" and "C" Ground Engineer's examinations and is now temporarily employed by the Club.

THE BRISTOL AVIATION BALL

Held on Friday, February 16, the Ball given by the Bristol and Wessex Aeroplane Club was probably the most

successful function of this kind since its institution some years ago. Well over 200 attended and on this particular occasion there did not seem any necessity for things like a " Paul Jones " to " break the ice." Everyone obviously enjoyed themselves greatly, and we hope will induce their friends to become members of the Club as a result. An excellent cabaret enlivened the proceedings, in which the dancing of the St. John sisters and of Ronald Green, with his partner, Mrs. Robertson, was as good as could be wished for. Hugh Frossard's Band supplied the melody for dancing, and evidently did it so well that there was little sign of anyone leaving before the advertised finishing time. Capt. L. P. Winters, Manager of the Airport, is to be congratulated on providing such an excellent entertainment for the members.

NORFOLK AND NORWICH AERO CLUB

During the last fortnight Mr. A. R. Cox took up his first passenger and Mrs. F. Crossley successfully completed her tests for a licence. Mr. J. Collier gave instruction to Messrs. G. R. F. Clarke, J. C. Smith, R. Rushmer, R. T. W. Ketton-Cremer and Mrs. F. Crossley. Solo flights were made by Mrs. Crossley, Miss Hudd, Sir Ralph Hare, Messrs. A. J. S. Morris, A. Kirkby, S. Hansel, J. C. Smith, H. C. Stringer, A. R. Cox, R. Forestier-Walker, F. Rushmer and R. T. W. Ketton-Cremer. Before giving an address at the Guildhall on Tuesday, February 13, Sir Harry Brittain paid a visit to the Club, accompanied by Mr. H. P. Gowen, the Chairman of the Norwich Publicity Association, and Mr. Felce, the Secretary. The Club is continuing the series of Visitors' Nights, which are held every Thursday evening. The Annual Dinner and Dance will be held at the Arlington Rooms on Friday, March 2. On Friday, March 23, Prof. D. Atkinson will give a lecture on " Archæology." This will be given in the clubhouse to members of the Club and members of the Norfolk and Norwich Archæological Society. The lecture will be illustrated by lantern slides made from air photographs taken by the Club.

SOUTHERN AERO CLUB

New members are Messrs. R. H. Wood and E. A. Vinter. Mr. J. E. Wilson has re-joined; he took an " A " licence with the Club in 1931 and a " B " licence in 1933. Mr. Wilson has purchased a Desoutter which is being reconditioned at the Southern Aircraft, Ltd., works.

JOHANNESBURG AERONAUTICAL ASSOCIATION

South West Africa, for the week ending January 21, has been cut off from all communication with the Union except by sea and air, and Mr. G. B. D. Williams has taken a " Fox Moth " to help ferry passengers and mails. Weather conditions have been appalling, with heavy rain and mists, and Mrs. Haggie and Capt. Douglas have been held up at Vereeniging. Mr. Stanley Pearce and Mr. Percy Hunt were able to get through from Capetown in a " Leopard Moth." Flying time for the week totalled 43 hr.

Airisms from the Four Winds

Tasman Sea flown again

MR. CHARLES ULM arrived at Sydney from New Zealand on Saturday, February 17, after having flown across the Tasman Sea. Mr. Ulm was flying the *Faith in Australia*, and carried the first official trans-Tasman air mail, consisting of 39,600 letters.

Gliding record

A REPORT from Rio de Janeiro states that a man named Dittman, in a " Condor " Glider, has attained a height of 4,200 m. (about 13,700 ft.), which is claimed as a world's record.

Sir Malcolm Campbell for South Africa

SIR MALCOLM CAMPBELL sailed for South Africa in the Union Castle liner *Arundel Castle* on Saturday, February 17. He is taking with him a geologist and an aeroplane. It is stated that Sir Malcolm intends to search for a gold reef in the Kalahari Desert.

England—Australia air race

AN important announcement in connection with the international air race from England to Melbourne has been made by Mr. Cole, the deputy chairman of the Centenary Air Race Committee. There is nothing in the rules, says Mr. Cole, to prevent relief pilots beings stationed on the route as relays, but the chief pilot must fly throughout the whole journey.

One of the first entries for the England-Australia air race has been received by the Royal Aero Club. The entrant is Mr. A. L. T. Naish, a director of Aircraft Exchange and Mart, and the machine entered an Airspeed " Courier " fitted with an Armstrong Siddeley " Cheetah " engine (260 h.p.). Mr. Naish will be chief pilot, and will be accompanied by Mr. S. Lewis Turner as assistant pilot.

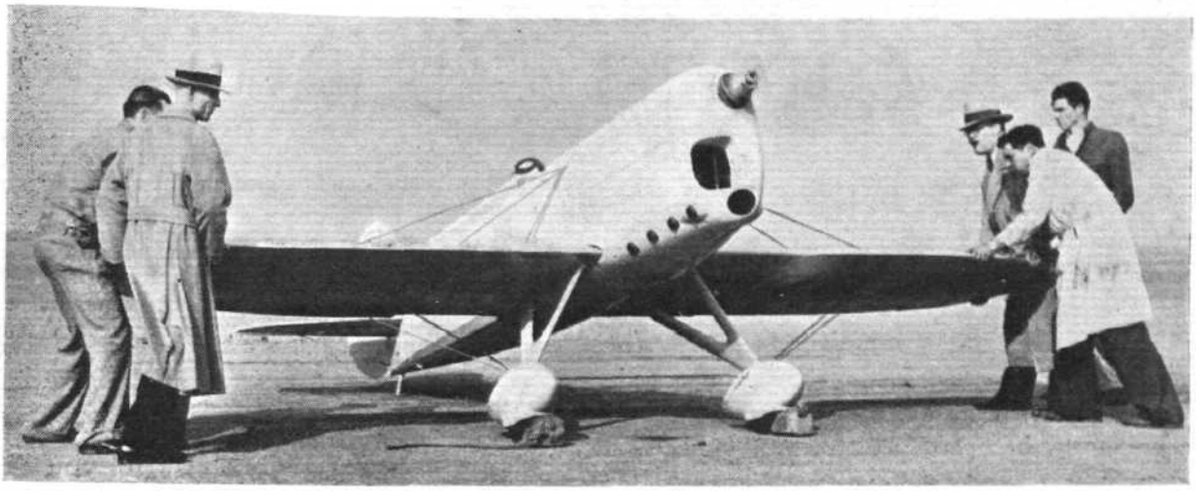
It is interesting to hear the views of possible competitors in the MacRobertson race on which type of aircraft is best suited to the event. According to Mr. Z. D. Granville, manufacturer of the well-known Gee Bee racing aircraft, there are distinct schools of thought. One maintains that the best aircraft for the race would be a very fast aeroplane with medium range, while the other thinks that long range, a crew of two or more and a reasonably high cruising speed offer the best chance of success. In accordance with these theories, the Granville Miller and De Lackner Co. are constructing two machines, the first of which will be called the Gee Bee " International Courier " and the second the Gee Bee " International Supersportster R.5." The " International Courier " will carry a crew of three, will have a cruising speed of 200 m.p.h., and an endurance of 16 hr. The wing area is 390 sq. ft., weight empty 3,685 lb., gross flying weight 10,000 lb., wing loading 25.6 lb./sq. ft., and power loading 14 lb./h.p. A top speed of 230 m.p.h. is expected. The " International Supersportster R.5 " will be a single-seater machine with a Pratt & Whitney " Hornet " of 825 h.p. The gross weight will be 5,040 lb., wing area 144 sq. ft., span 30 ft., height 8 ft. 4 in., track 7 ft. 6 in., power loading 6.1 lb./h.p., wing loading 35 lb./sq. ft., and weight empty 2,200 lb. A cruising speed of 260 m.p.h. should be obtained and the maximum speed will be about 285 m.p.h. With flaps, the landing speed of the aircraft should be 45 to 50 m.p.h. The range is expected to be 1,850 miles.

London—Birmingham air service

DURING the period of the British Industries Fair a daily air service will be operated between London and Birmingham. The machines will leave Heston at 9.15 a.m. and reach Castle Bromwich an hour later. The return journey will begin at 5.30 p.m., arriving back at Heston at 6.30 p.m. The service is being operated by Midland & Scottish Air Ferries, using an Airspeed " Ferry." Bookings are received by the British Air Navigation Co. at Heston.

Heresy!

IN the *Sunday Express* of February 18 the City Editor of the paper wrote about President Roosevelt's cancellation of the air mail contracts:—" The President's withdrawal of the aircraft subsidy is an excellent move. There is no sound reason why aerial transport should be subsidised by the taxpayer against the older forms of transport. There is also no justification for the payment of dividends by taxpayers to shareholders in aviation companies. Aircraft has its place in commerce, but it is a limited place, and those who want it should pay for it without assistance. Probably the only air services which pay are those in Colombia over the Andes Mountains and the London and Paris route. There is no case for subsidising commercial aircraft on military grounds. Many more military craft could be purchased if commercial subsidies were taken away." Subsidies and mail contracts are analogous to Protection, and even that great pioneer of Free Trade, Adam Smith, allowed that it was legitimate to protect an infant industry. Air transport is certainly an infant industry, and as such is a particularly suitable case for a form of protection by the State. It is subsidised because it is certain that once it has reached adolescence it will be of great benefit to the community. We are not pre-judging the special case of the U.S.A. mail contracts, but as a general principle we cannot allow heresies like the above to pass without protest.



TO BREAK THE CAUDRON RECORD : A small high-speed low-wing monoplane, designed and built by Larry Brown, of Santa Monica, California, to attack world's records in its class. It is fitted with a 185 h.p. "Menasco" 4 cyl.-in line air-cooled engine, and is claimed to have a speed round about 240 m.p.h.

"Glad to meet yer!"

WE quote the following from the *Daily Mail*:—"Dodging a flaming meteor in mid-air is the novel experience related by Mr. Hiram Sheridan, an airman, when he arrived to-day at Littlerock, Arkansas, with the air mail from Forth Worth, Texas. 'When I first saw the meteor,' said Mr. Sheridan, 'it was just entering the stratosphere and giving out a dazzling blue and white light that blinded me. It described a great arc and seemed to be coming straight for my aeroplane. I watched it for a minute,' he declared, 'and then changed my course and increased my speed, but still the meteor looked as though it would strike my machine. As it approached me it lost its brilliance, and by the time it was on a level with me it was a glowing red ball. Barely missing the aeroplane, it went out after passing on its way to earth. Until I turned sharply to the right I felt sure something tragic was going to happen.'"

The new de Havilland factory

THE contract for the general builders' work at the new de Havilland Aircraft Factory at Hatfield has been awarded to Holland Hannen & Cubitt's. The work includes a single-storey factory, covering an area of 190,000 sq. ft., a large two-storey modern office and administration building, canteen and club-rooms, boiler house, timber sheds, roadway, etc. The amount involved is £117,000. The fabrication of the steelwork was let some weeks back to Redpath Brown & Co. It is expected that the new factory will be ready for occupation during the summer of this year. The architects are Jones M. Munro & Son, of Glasgow.

Paris International Aviation Exhibition, 1934

THE Managing Committee of the Syndical Chamber of Aeronautical Industries has just decided that the XIV International Aviation Exhibition, organised by the Syndical Chamber, will be held in Paris, in the Grand-Palais des Champs-Elysées, from November 16 to December 2, 1934. Mr. André Granet has been nominated Commissioner General of the Exhibition.

"The Romance of Flight"

A LANTERN LECTURE on "The Romance of Flight" will be given on behalf of the British Red Cross Society and Order of St. John Hospital Library, by Mr. J. E. Hodgson, Hon. F.R.Ae.S., in the London School of Economics, Houghton Street, Aldwych, W.C.2. The Chairman will be Kathleen, Countess of Drogheda, C.B.E., and the lecturer will be introduced by Mr. C. R. Fairey, M.B.E., F.R.Ae.S. The lecture, which will be held on March 9, will be illustrated by many slides made from old engravings. Tickets can be obtained from Mrs. M. E. Roberts, Organising Secretary, British Red Cross Society, and Order of St. John Hospital Library, 48, Queen's Gardens, Lancaster Gate, W.2.

"Speed and the Economics of Air Transport"

ON Thursday, March 1, Maj. F. M. Green, F.R.Ae.S., M.Inst.C.E., will lecture before the Royal Aeronautical Society on "Speed and the Economics of Air Transport." Maj. Green's investigations into the controversial subject of the speed of commercial aircraft were considered of such importance by a sub-committee of the Aeronautical Research Committee that it was suggested they should be amplified and made public by means of a lecture before the Society. In view of the high speeds which are often suggested, Maj. Green's conclusion "the cruising speed that I calculate to be the most economical is between 130 and 140 miles an hour" is one which may well prove controversial. "Unless something entirely new is devised in aeronautics I am afraid that it will be very costly to fly at speeds much above those which I have indicated as economic" is Maj. Green's final conclusion. Maj. Green gives fully the assumptions upon which his conclusions are based. The lecture, which will be fully illustrated, will be delivered in the Lecture Hall of the Royal Society of Arts at 6.30 p.m. Visitors will be admitted on signing the Visitors' Book in the Entrance Hall. Advance proofs may be obtained, price 6d. each or 7d. post free.

Long-distance record

ROSSI AND CODOS are proposing to make another attempt on the Long-Distance Record on the Blériot monoplane. The start will be made from Istres Aerodrome, Marseilles, about February 24, and the Royal Aero Club, at the request of the Aero Club de France, has appointed officials at Calcutta and Rangoon to observe the passing at these points.

Empire Air Day

AIR clubs all over the country have promised to co-operate in the Empire Air Day which the Air League of the British Empire is organising on Empire Day, May 24. The clubs will admit the public to their hangars and workshops and give demonstrations of the training of pilots. Among them are:—The Brooklands Flying Club; the Scottish Flying Club; the Kent Flying Club; the Lincolnshire Aero Club; the Hampshire Aeroplane Club; the Midland Aero Club; the Cotswold Aero Club, Gloucester; the Leicester Aero Club. Empire Air Day has also received the approval of the Royal Aeronautical Society and of the General Council of Associated Light Aeroplane Clubs, who recommend that all their affiliated clubs should support it. By permission of the Society of British Aircraft Constructors, the public will be allowed "behind the scenes" of British aviation on this one day. For the first time it will be possible to see aeroplanes and aeroplane engines being constructed. At some places flying tests of new machines will be carried out in public. Imperial Airways will have a special display at Croydon Airport and certain parts of the airport not usually open will be accessible. Service aerodromes, admission to which is normally prohibited, will also be thrown open, and for once the daily routine of an R.A.F. squadron will take place in public. Sir Stenson Cooke, Secretary of the Automobile Association, has told the Air League that this body will help by putting up special road signs to show the way to airports and aeroplane factories. The Air League hopes that Empire Air Day will be an annual festival on May 24. The purpose of such a day is threefold:—(1) To arouse greater public interest in flying and a more enlightened public opinion about flying matters; (2) to encourage flying itself; (3) to hasten the progress of Imperial air development.

Airport News

CROYDON

I AM informed that Imperial Airways, Ltd., have a large programme on hand for next summer. Their fleet will be augmented by seven new passenger machines all of which should be in service by the end of June. Empire services will no longer have any train link between Paris and Brindisi after the beginning of June, so that passengers embarking at Croydon will have an " air all the way " service next summer.

Before the authorities know where they are Croydon will be far too small for the traffic with which it will have to deal. If all that is planned for next summer bears fruit there may be a lack of housing accommodation for aircraft at Croydon. According to newspaper reports the railway companies will take a hand at the operation of internal airlines in England next summer. Already we were looking forward to a season of intensive continental traffic and now it seems we may see G.W.R., L.M.S., and L.N.E.R. machines at Croydon, setting down and picking up passengers of the Continental, Far Eastern and African airliners. It is said that Imperial Airways, Ltd., will operate the railway airlines with their pilots and ground staff.

An announcement is also made that Provincial Airways, Ltd., will shortly commence air links between Croydon and Southampton, Portsmouth, Plymouth and as far west as Hayle in Cornwall. The fare to Southampton is given as £1 10s. and Croydon-Plymouth as £3 2s. Numerous other places such as Bournemouth, Dorchester, Weymouth, Halden, Exeter, Teignmouth, Dawlish, Torquay, Paignton and Newton Abbot are mentioned. It is not clear whether the company proposes to stop at all these places between Croydon and Plymouth. If so, very fast machines will be needed to make up for time spent on the ground. The fact that this private company is about to start operations on a route which the G.W.R. has always regarded as of particular interest, both in rail and road transport, leads one to wonder what will happen if a railway-air service is operated between Plymouth and London by Imperial Airways, Ltd., on behalf of the railway company.

On Monday last Croydon for the first time in history was the scene of a Nazi demonstration when two officials of that party in full uniform, complete with swastika, arrived from Berlin by D.L.H. They were, respectively, a member of the Nazi Publicity Department and a Commander of one of Herr Hitler's numerous bodyguards. The object of their visit to England is stated to be to make contact with British Fascisti and sympathisers with the German *régime* of to-day. It is to be hoped contact will not be made with any members of the various anti-Fascist groups, and a tour of Whitechapel is not thought to be on the visitors' sight-seeing programme. It is questionable whether the wearing of uniform on such a visit is altogether necessary or desirable.

[It has since been stated that the two young Nazis are to be severely punished by the Nazi authorities for wearing uniform in a foreign country.—ED.]

An interesting event recently was a farewell luncheon to Mr. Gordon P. Olley, who for so many years has been intimately connected with airline flying and with Imperial Airways, Ltd. Maj. Brackley was in the chair and some of Mr. Olley's oldest colleagues were present. These included Messrs. Walters, Rogers, Youell, Wilcockson, Perry, Tweedie, Patterson, Messenger and Hay. Messrs. O. P. Jones, Horsey and Dismore were only prevented from being present because somebody had to do the day's flying. Mr. Brenard, of Imperial Airways' Publicity Department, whose long experience of airline pilots causes him to regard them with a fatherly but not unsuspicious eye, was also present.

The tragic death of H.M. the King of the Belgians caused great activity amongst Croydon air traffic companies. There are no regular airline departures to or arrivals from Brussels on Sundays, and air taxis were in great demand by the Press. Mr. Crundall, of Air Taxis, Ltd., was away by 8 a.m. and back with photographs by 5 p.m., and Surrey Flying Services did more than one trip to Brussels and back.

Croydon has been wondering if " fog " causes notabilities to hibernate. There has seldom been so poor a week for important names on passenger lists as last week, nor has there often been so trying a period of fog and bad flying weather as during the past few weeks. Thanks largely to alternative airports, services to and from the Continent have been operated with very few failures.

M. Cocquyt, chief pilot of Sabena, reports that the new idea of painting the Croydon boundary fence black and white is a good one. In misty conditions and even in fairly thick weather a pilot can follow the fence with his eye remarkably well.

Somebody living in the vicinity of Banstead tells me that upon the Banstead Downs, where Pepys went horse racing, it is very frequently clear and sunny when Croydon is foggy. With proper, swift ground connection with London, Banstead Downs might have made a better Airport of London than Croydon which, much as we love it, participates a little too freely in London's particular brand of soup-coloured fog.

A. VIATOR.

HESTON

SPRAY painting can now be done in almost any of the aerodrome buildings. This has been made possible by the purchase of a large water-cooled air compressor, which has been installed in the main Service Hangar. The original compressor used in the paint shop has been passed on to the Airwork Manchester branch at Barton. The air is piped to the forge, welding shop, etc., so that it is now possible to use pneumatic riveters or spray gun in almost any part of the workshops, and to execute small painting jobs on the spot without loss of time in transferring to the paint shop.

The British Air Navigation Co.'s three-engined Ford left Heston on February 14, loaded up with 1½ tons of Columbia wireless equipment, which was rushed to Belgium to escape the 40 per cent. tariff which came into force the following day.

Mr. Seymour, the proprietor of Seymour's Hotels in Jersey, travelled to Jersey from Heston on Thursday morning, in a specially chartered aeroplane from Birkett Air Service, which was able to leave at 2.15 p.m., despite the thick fog.

Ordinary people, as distinct from special Press flights, flew on 281 days of the 365 last year, an average of 23 flying days a month. The peak weather months were April and August, with 27 fine days. During the nine months from March to November inclusive, a steady level was maintained which never fell below 24 for any month, and November, during which the school carried out 150 per cent. more flying than in November, 1932, had 26 flying days to its credit. The black months, with only 16 fine days, were January and December.

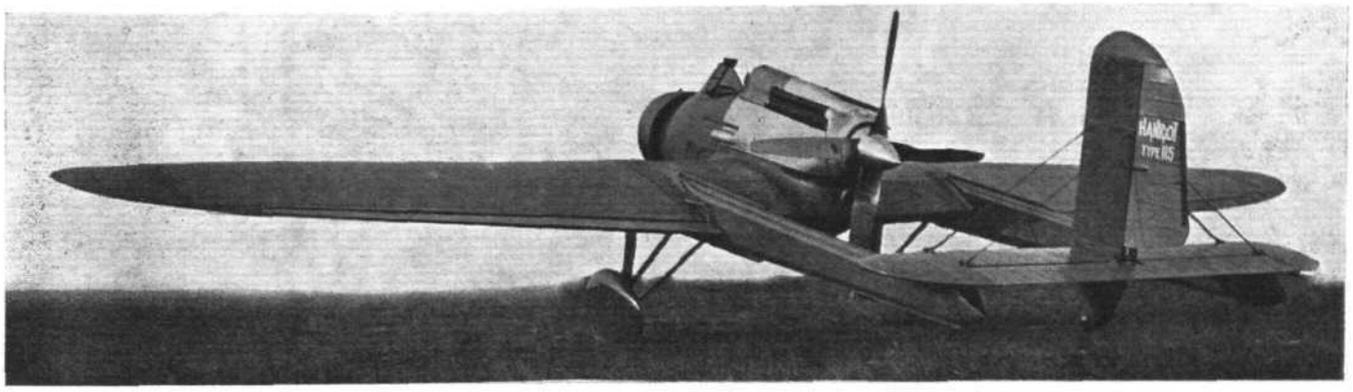
Littlestone air light

THE colour of the air light at Littlestone landing ground, latitude 51°01′N., longitude 0°59′E., was changed from white to red on January 30, 1934, and the range of visibility of this light in consequence reduced from 24 miles to 15 miles.

Night flying without navigation lights

ROYAL AIR FORCE aircraft may be flying by night over the areas described below, between the times and during the periods mentioned. Above the altitudes given the aircraft will not exhibit navigation lights unless other aircraft are observed in their vicinity:—Area.—Within a radius of 10 miles of Falmouth. Time and period.—Between 20.00 and 21.00 hours, on Mondays, Tuesdays, and Thursdays, until March 31, 1934. Altitude.—2,000 ft. Area.—Within a radius of 10 miles of Fowey. Time and period.—Between 20.00 and 21.00 hours, on Mondays, Tuesdays, and Thursdays, until March 31, 1934. Altitude. —2,000 ft.

NEW AIRCRAFT



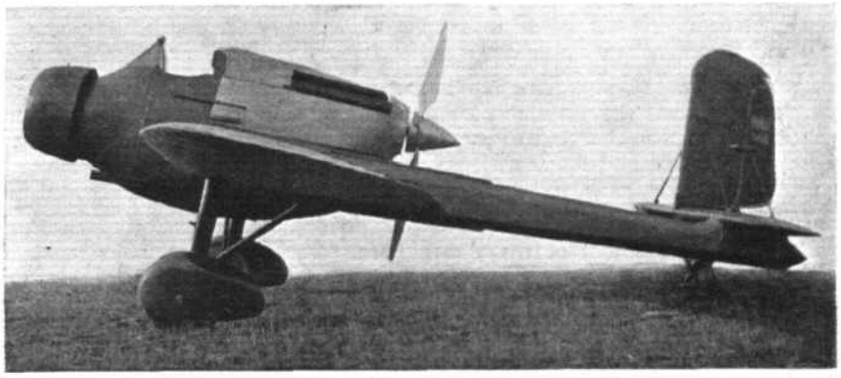
The Hanriot 110

PROBABLY the most unorthodox single-seater fighter built during recent years is the Hanriot 110 produced by the Compagnie des Avions Hanriot, of Arcueil, Seine. As may be seen from the photographs, the machine is a low wing cantilever pusher monoplane. The engine is a Hispano-Suiza 12 X brs. giving 650 h.p. at 13,120 ft. which drives an adjustable-pitch metal propeller. The wing, which is in three sections, is of the normal two-spar type, Frise ailerons of high aspect ratio being hinged to the outer sections. Pilot, engine, military equipment, radiator, etc., are carried in a central nacelle and a stout bulkhead is provided between the engine and the pilot to give some protection to the pilot's head in the event of a crash. The tail is carried on two parallel booms, which house the control wires. Tail plane and elevator are mounted at the ends of these booms and the fin and rudder are carried centrally above them. At present an undercarriage of the conventional split type is fitted, but this may later be replaced by a retractable version.

One particularly interesting feature of the aircraft is the radiator which is of the Chausson type. This is in the form of a ring mounted in the nose and enclosed by an N.A.C.A. type cowling. A movable cone forms the nose of the nacelle and in its normal position allows the maximum passage of air through the cowling. When this cone is moved forward the passage of air is restricted.

The aircraft may be armed with either two Chatellerault rifle calibre machine guns or a 33-mm. automatic quick-firing gun.

The principal dimensions of the Hanriot 110 are:—Span, 44 ft. 4 in. (13,5 m.); o.a. length, 26 ft. 1 in. (7,9 m.); o.a. height, 9 ft. (2,775 m.); track, 10 ft. (3,1 m.); wing area, 278.6 sq. ft. (25,9 m.²), vertical surface area, 17.25 sq. ft. (1,603 m.²); tailplane area, 31.7 sq. ft. (2,95 m.²); elevator area, 11.4 sq. ft. (1,066 m.²).



A PUSHER FIGHTER : Three views of the Hanriot 110. Note, in the front and side views, the Chausson radiator in the nose.

The Breguet 41

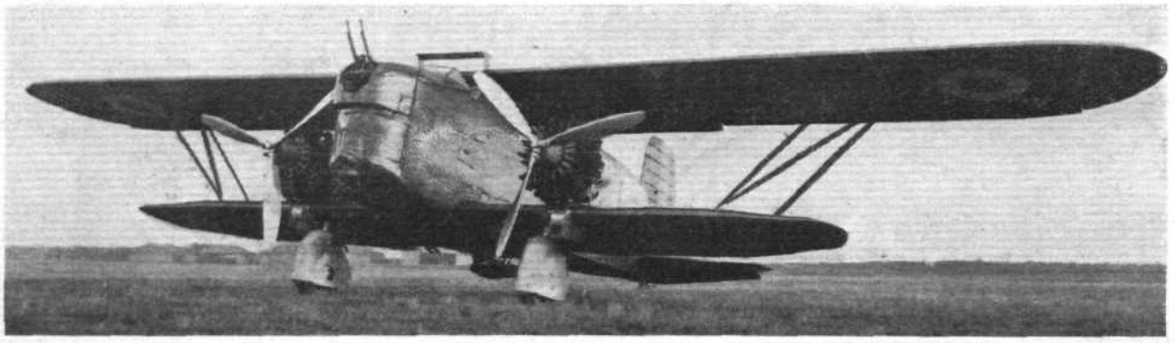
THE Breguet 41 is classed by its manufacturers as a multi-seater fighter, reconnaissance machine and bomber, although it is usually referred to as "multiplace de combat." The aircraft is a single-bay sesquiplane braced by a single pair of "N" interplane struts on each side of the fuselage. The wings have a small negative stagger. The outer sections of the upper main plane are attached to a centre section on top of the fuselage, while the lower plane, which is in one piece, is built round a single spar. Trailing edge flaps are fitted to the upper planes. Just behind the pilot's cockpit above the leading edge of the top wing is a small auxiliary aerofoil, the purpose of which is to correct any disturbance in the air flow caused by the cockpit.

The main structure of the 41 differs from that of the better known 27 machine in that it is not built of a frame of two box girders joined by a third member, but consists of a fuselage which fills the entire gap between the wings, at the end of which is a box spar which carries the tail unit. The main portion of the fuselage is built up of several transverse frames connected by four longerons and diagonal members, the whole being covered by alloy sheeting riveted to the framework. The exceptionally clean undercarriage, which is of a similar type to that used on the well-known Breguet 27, may be seen in the accompanying illustration.

The nose of the fuselage is transparent and contains an enclosed turret for the forward gunner. This turret is attached to and revolves with the gun ring in a similar way to the "parrot cage" used on our own Bristol 120. Twin guns (Lewis or similar type) protrude through an opening in the turret. Contrary to some reports, fixed

THE BREGUET 41 TYPES

Breguet 41-1	Weight empty	6,640 lb.
	Weight loaded	10,100 lb.
	Maximum speed	153 m.p.h.
	Climb to 13,120 ft.	11 min.
Breguet 41-2	Weight empty	7,002 lb.
	Weight loaded	13,640 lb.
	Maximum speed	165 m.p.h.
	Climb to 13,120 ft.	10 min. 30 sec.
Breguet 41-3	Weight empty	7,230 lb.
	Weight loaded	13,720 lb.
	Speed at 13,120 ft.	196 m.p.h.
	Climb to 13,120 ft.	7 min.
Breguet 41-4	Weight loaded	13,400 lb.
	Speed at 13,120 ft.	189·5 m.p.h.
	Climb to 13,120 ft.	7 min. 3 sec.



THE "MULTIPLACE DE COMBAT": The Breguet 41 is shown above fitted with Gnome-Rhône 14 K brs. radials, but Hispano Suiza engines are also installed. The radial engines have now been fitted with N.A.C.A. type cowlings.

guns are not fitted to the Breguet 41. An open cockpit for the pilot, who is seated on the left-hand side of the fuselage, is situated just in front of the leading edge of the top plane. An auxiliary pilot's position fitted with a hinged window is located in the fuselage. The navigator's position is to the right of and below the pilot's seat beneath which wireless is installed in a position easily accessible to the navigator, and the bomber's position is on the port side beneath the top plane. An efficient system of communication is provided between the pilot and the other members of the crew. Behind the wings is a well sheltered position for the rear gunner with a mounting for twin guns. A very excellent field of fire is obtained in this position, as the spar which supports the tail unit, unlike the conventional type of fuselage, is of a very small cross section. Another position for a downward firing gun may be provided beneath this position.

A variety of engines may be installed, and the aircraft has a separate type number for each installation. When fitted with two Hispano Suiza 12 H.B. 500-h.p. engines the type is known as the 41-1; with two Hispano-Suiza 12 N.B. engines of 650 h.p., as the 41-2; with two Hispano-Suiza 12 Y brs. engines (840 h.p. at 13,120 ft.), as the 41-3; and with two Gnome-Rhône 14 K brs. geared and supercharged radial engines, as the 41-4. With its concentration of mass, this machine has quite remarkable powers of manœuvre, and has been ordered in large quantities for the "Armée de l'Air."

THE R.A.F. AT ADEN AND BASRA

IT is several years since the Imam of Zeid gave serious trouble to the Aden Protectorate by invading and occupying our protected territories. He and his troops were driven out by the Fairey 3F. bombers of No. 8 (Bomber) Squadron in an almost bloodless war, which so shook the prestige of the Imam that the tribesmen of the protected territories took heart of grace, rose, and hustled the Imam's troops out of their country. Since then there has been no serious trouble, but even now "incidents" occur at intervals. Last July a party of tribesmen from the Imam's country made a raid on two villages near the foot of the Thirra Pass, some 100 miles N.E. of Aden. The villagers are stout men and they put up a lively resistance. Whilst a merry little fight was in progress, it so happened that a formation of No. 8 B.S., returning from Mukalla to Aden, flew over the scene of the fray. The Zeidi leader, muttering "May Shaitan fly away with the R.A.F.! How on earth did they hear about this little private tea party of mine"! or words to that effect, immediately ordered a retreat, while all the villagers in the neighbourhood, confirmed in their belief that the friends of the British were always sure of help (poor benighted Asiatics!), immediately mustered in force and saw the raiders to the door.

None the less, in August it was reported that 30 Zeidi troops with 400 Yemeni tribesmen had raided another part of the Protectorate and had carried off some prisoners and livestock. What is more, a British subject was prevented from anchoring his dhow and landing on Protectorate territory. The district where this occurred was remote, and some time elapsed before a report reached the Resident at Aden. When it did, he was very properly wrathful, and sent a strong demand for full restitution to the Imam's representative at Taiz. No notice was taken, and another small raid was made in September to collect taxes which were certainly not legally due to the Imam. Then evasive replies were sent to the Resident, coupled with promises of restitution, which were not carried out. Some prisoners were released, but the more important ones were kept as hostages, while, as a great concession, the owners of the camels, etc., were allowed to pay a ransom to get their property back. Then the Resident sent a Fairey 3F. to the official at Taiz and to the Imam, with a message which said in the most urbane Arabic, "Any more of your lip, and I'll let No. 8 B.S. loose at you." Full restitution was then made.

Suppose we had had no aeroplanes at Aden, how could we possibly have protected our subjects and feudatory tribesmen? The answer would appear to be what the dictionary calls a syncarpous, polycarpellary fruit of the *citrus medica limon*.

The R.A.F. Commands of Aden and Iraq are mutually interested in developing a coastal route between Basra and Aden. That part of the coast which lies between the Gulf of Oman, where the "Atalantas" of Imperial Airways pass on their way to India, and the Hadramaut coast just to the east of Aden, is very imperfectly explored and mapped, and when the aircraft from both sides have set out to look for suitable landing grounds, flying-boat bases and anchorages, they have found the tribesmen on the coast far from anxious to assist them. However, the aircraft persisted, and the first stage of success was marked when "Rangoon" boats of No. 203 (F.B.) Squadron at Basra met Faireys of No. 8 B.S. at Murbat in December, 1931.

Last November a further success was registered, when two "Rangoons" flew all the way from Basra right through to Aden, a distance of 4,000 miles. The time may come (who knows?) when it may be very important to be able to fly right round the coast from Suez to Basra *via* Aden.

Apart from the exploration flights, which must be of intense interest, the squadrons at Basra have occasional little excitements of their own. Last July information was received that Beduin tribes round Sharjah, which is a station near the Gulf of Oman, where passengers by Imperial Airways spend a night, were in a state of unrest because the Sheikh of Sharjah had not paid them their usual allowances, and the rumours went so far as to state that the tribes meant to mark their displeasure by making an attack on the resthouse. It was at once decided to make an air demonstration over those tribes, and No. 84 (Bomber) Squadron at Shaibah, near Basra, fitted four "Wapitis" with tanks for a long-range flight. Meanwhile the Residency Agent at Sharjah reported that the situation had been much exaggerated, but it was thought that none the less it would do no harm for the "Wapitis" to carry out their programme. It would be a good practice flight if nothing else. So the flight was made, and it took the machines 7½ hours only to arrive at Sharjah non-stop from Shaibah. For the next two days they carried out demonstration flights over the tribal area, and as the situation was then normal, they flew home again. Quite a good performance!

Correspondence

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

AIRCRAFT v. RAILCAR

[2913] I have noticed with pleasure that FLIGHT has constantly made a point of advocating higher operating speeds for British commercial airlines.

This point must be emphasised by an article, published in *The Engineer*, dated 2nd inst., which deals with the operation by the German Railway Co. of railcars on some of their lines. These railcars, which cannot for long be confined to Germany, are fitted with Daimler-Benz Diesel engines of from 150-330 b.h.p., and *they can attain a speed of 100 m.p.h.* This probably means that they are capable of maintaining average speeds, over long distances, of anything up to 80 m.p.h.

If the British air transport companies continue their policy of employing comparatively low average operating speeds, I suggest that they will have, in the near future, a very serious rival in these railcars.

Using Diesel engines of such low power, they cannot help being economic: it has been pointed out that they are fast, and they will obviously be made as comfortable as possible.

The only thing therefore, that our commercial airlines can do to combat this potential agent for decreasing their traffic returns is considerably, very considerably, to increase their operating speeds.

London, N.W.11. A. L. FERMOR.
February 6, 1934.

DIRECT LIFT

[2914] For some months past I have been following with intense interest every machine whose performance and loadings have been published, and cannot help but admire the way in which engineers and designers have been concentrating on lifting from a short run, but one does not need to be very well versed in aerodynamics to realise that we shall shortly arrive at that stage where it will be impossible to leave the ground quicker.

If we seriously set ourselves out to discover why this is ultimately to happen, we find that there is one force which is used by every designer, the use of which is one of the two obstacles to be overcome before we can hope to rise vertically. I refer to forward motion.

Until such time as forward motion is entirely dissociated from lift, we cannot rise vertically from the ground.

Obviously, if the foregoing reasoning is correct, we should set ourselves out to find the remedy, and the remedy lies in conducting our experiments not on forward speed, but on direct lift.

The gigantic strides made in engine design, structural design and streamlining, have all had a retarding influence on the progress that should have been made towards obtaining direct lift, and if the amount of thought and skill, not to mention inventive genius that has been expended on the desire for speed, had been utilised on obtaining direct lift, we should have a far different-looking aeroplane than that which we have to-day.

We are in the same position to-day as regards lift as we were ten years ago, the only difference being that owing to the terrific acceleration and power obtained from the present-day engine, we have been enabled to cut down wing area and increase wing loading, but we have not developed wing design as we might.

We may only lift with wings if we create a pressure of air under them, and knowing that we cannot do this without using forward motion, we have been content to blindfold ourselves to any other method.

There is another method of obtaining lift, and science has known of it even before it was realised that planes would lift.

This method is arrived at by revolving the wings instead of towing them, but here is the spot where even science has not been successful in solving the problem.

No known means of applying power to the rotating planes has yet been devised without the re-action from the power unit setting up gyratory motion to the machine in which it was placed immediately it had left the ground.

Evidently this method of lifting has been condemned for the easier way at present in vogue, although I have certain plans and information that torque re-action has been harnessed in such a manner that it has been even used to advantage instead of being the unsurmountable obstacle it previously was.

This statement may cause some controversy, as it may be quoted that the Autogiro type of machine is not affected by re-action, but this is not so, because the revolving planes, or to be more precise, the rotor, are definitely not driven by mechanical means when in the air.

If the rotor were to be positively driven by direct power, the re-action is bound to set up gyration of the body in a moment opposite to that of the rotor, and this gyration is definitely a force that cannot be counteracted or controlled except by its own re-actionary efforts.

In other words, re-action can only be overcome by re-action.

The form the re-action takes is the deciding factor, and a few brief words are sufficient to give the solution to the problem.

This is the answer. Instead of trying to hold a body against re-action, utilise re-action as a driving force.

Perhaps the foregoing will set one or two minds working along new lines and peradventure open up some new theories on the subject of direct lifting aircraft.

As a finishing touch may I be allowed to give my idea of the general aircraft of the future?

The machine will be composed of a streamlined fuselage, with passenger accommodation forward, rotor engine amidships, and pusher air-screw at the rear.

The fuselage will be made to enable the machine to float in water, there will be no under-carriage, no wings, and only a rudder forward of the air-screw for direction control.

The machine will be amphibian, as it can land vertically downwards and rise perpendicularly, therefore requiring no undercarriage, and if made watertight can do the same on water.

The horse power required to drive it will be comparatively small, as the drag will be not nearly so great on account of the clean, undisturbed streamline that can be arranged with no obstructions; consequently there should be great possibilities for development.

I might take this opportunity of stating that this type of machine will rise, hover or land on a perfectly even keel, and that there are no freak principles involved, such as exerting power in two directions at the same time and accepting the result as direct lift.

I wish to thank the Editor of FLIGHT for many hours of interesting reading, and also for the valuable information that invariably finds its way to its columns through his generosity. ALBERT E. WILDE.

Liverpool.
February 15, 1934.

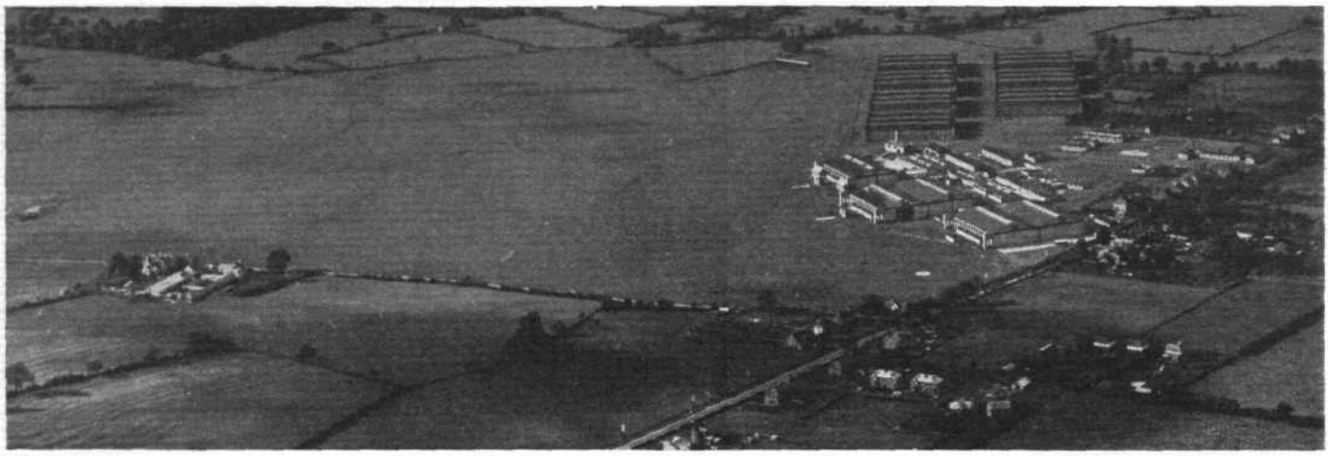
RUNNING COSTS

[2915] I am a reader of FLIGHT and also a regular purchaser of a motoring magazine. The latter frequently publishes under the heading of Readers' Experiences, a brief survey of the running costs of various makes of cars over a number of years. The articles enumerate the expenses of garaging, repairs, insurance and fuel consumption, the information being supplied by car owners who have collected and tabulated appropriate information. The increasing popularity of the light aeroplane as a substitute, or at least as an ally, of the sporting and touring type of car, suggests to me that the time is ripe for the co-operation of some owner-pilot in the preparation of a similar article suitable for insertion in the correspondence columns or elsewhere of this journal. This would supply an interesting comparison between private air travel and private motoring, which I feel confident would interest many readers who are owners of one or both types of machine.

I hope that my suggestion will meet with some response and be put into practice by some interested party in a position to supply reliable information.

Wallasey, Cheshire. D. COLLARD.
February 18, 1934.

The Industry



FROM ABOVE : An aerial view of the works of the Gloster Aircraft Co., Ltd., at Cheltenham. (FLIGHT *Photo.*)

HAWKER-GLOSTER AMALGAMATION

WITH regard to the amalgamation which has been announced of Hawker Aircraft, Ltd., and the Gloster Aircraft Co., Ltd., we are informed by the Hawker company that they have purchased the Gloster company with all assets.

Mr. T. O. M. Sopwith will be chairman of the two companies with Mr. F. Sigrist as joint managing director. Messrs. D. Longden and H. Burroughes will retain their seats on the Board of the Gloster company. Mr. F. S. Spriggs will be general organising manager and director of both companies with Mr. F. I. Bennett as chief engineer and director.

It is understood that the two companies will continue to operate as separate concerns, but the amalgamation will allow interchange of resources, patents and facilities generally.

Hawker's have at present many types of aircraft in service in the R.A.F., including the "Fury" and "Hart," together with their many specialised versions. They have therefore a very wide experience of modern aeroplanes with water-cooled engines (Rolls-Royce). The Gloster Company have recently received large orders for their day and night fighter, the "Gauntlet." This has a radial air-cooled engine (Bristol), so the new combine will have exceptional facilities for acquiring experience with both types of engine in high-speed machines.

THE D.H. TECHNICAL SCHOOL BALL

SUCH an occasion as the Annual Ball of the de Havilland Aeronautical Technical School affords an excellent opportunity to ascertain the nature of those people who will run the aviation industry in years to come. The man who knows how to enjoy himself and knows how to help others to do likewise is an asset to any industry. A visit to the de Havilland Technical School Ball, held at the Portman Rooms on February 16, left one feeling that the aircraft industry of the future will be in good hands.

About 400 guests attended the Ball, and assisted by Mr. Ronald Frankau and a group of high-stepping students enjoyed themselves to the full. Among the guests we noticed Capt. and Mrs. Geoffrey de Havilland and the directors and management of the company, Mr. T. P. Mills, Mr. H. Gillman of the S.B.A.C., Lt. Col. Burchall of Imperial Airways, Mr. J. A. Mollison, Maj. Hereward de Havilland, Mr. S. Scott-Hall, and Mr. Devereux of High Duty Alloys.

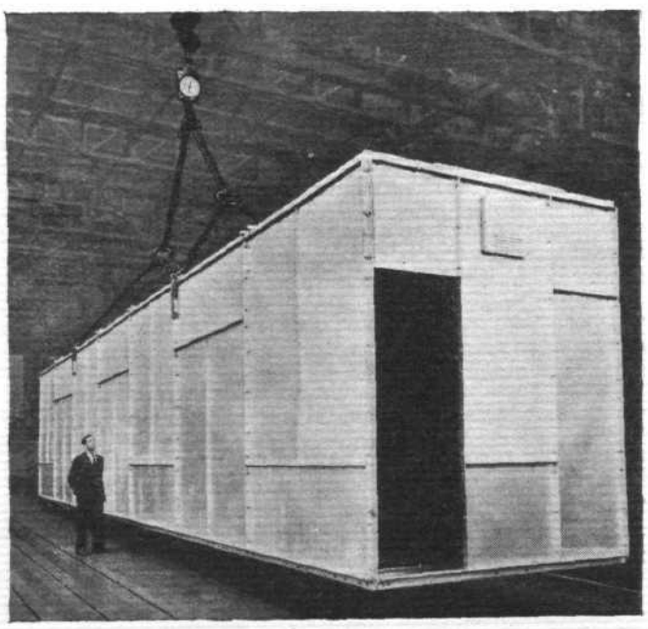
FOR EASY TRANSPORTATION

THE transportation of aircraft overseas has always been an irritating and expensive job. Aircraft parts are usually packed in wooden cases, the return of which, even if great care is taken to preserve the wood when the case is being dismantled, is not an economical proposition. The British Thomson-Houston Co., Ltd., have designed an all-steel container for accommodating aircraft of various sizes. A number of these containers have been supplied to the Air Ministry for the transportation abroad of such machines as the "Victoria," "Vildebeeste," "Wapiti," Fairey III.F and "Atlas." Three sets have also been supplied to the Supermarine Aviation Works (Vickers), Ltd., Southampton.

In general design, the B.T.H. containers are unique, since they are adjustable in size to suit various machines. They have a decided advantage over ordinary wooden cases in that after their contents have reached their destination the containers may be dismantled, the parts packed up in a minimum of space, and either stored or re-shipped for further use.

All the containers have been subjected to severe slinging, sagging and "hog-back" tests, the deflections recorded being negligible. One complete container was dismantled in less than an hour.

The Vickers "Victoria," for which the containers were originally designed, is transported in two containers, that for the cabin being 29 ft. 10 in. by 6 ft. 7 in. by 9 ft. 7 in., and the second, for the fuselage, being 30 ft. 10½ in. by 6 ft. 1 in. by 9 ft. 7 in. Each of three sets ordered by the Supermarine Aviation Works consists of one large and one small container, the former measuring 49 ft. 6 in. by 8 ft. 8 in. by 10 ft. 3 in., and the latter 29 ft. 4 in. by 9 ft. 6 in. by 12 ft. 3 in.



UNDER TEST : One of the large B.T.H. containers supplied to the Supermarine Aviation Works undergoing load tests at the B.T.H. factory at Willesden.

THE ROYAL AIR FORCE

London Gazette, February 13, 1934

General Duties Branch

Pilot Officer on probation E. H. Wheelwright is confirmed in rank (Jan. 6); F/O. F. Whittle is promoted to rank of Fl. Lt., with effect from and with seny. of Feb. 1, immediately preceding Fl. Lt. C. B. Hughes on the gradation list. P/O. J. A. Hotham is placed on retired list on account of ill-health (Feb. 9); Fl. Lt. H. W. Taylor is transferred to Reserve, class A (Feb. 11); Flt. Lt. G. D. Middleton is transferred to Reserve, class A (Feb. 11); F/O. E. A. H. Tanner is transferred to Reserve, class A (Feb. 9); F/O. L. T. Jearey resigns his short service commn. (Jan. 26); F/O. T. W. Walker (Lt. R. Tank Corps) relinquishes his temp. commn. on return to Army duty (Jan. 14).

Stores Branch

P/O. on probation D. F. Syder is confirmed in rank and promoted to rank of Flying Officer (Jan. 6).

ROYAL AIR FORCE RESERVE
RESERVE OF AIR FORCE OFFICERS

General Duties Branch

K. H. Salusbury-Hughes is granted a commn. as Pilot Officer on probation in class AAi (Feb. 13).

The follg Flying Officers are transferred from class C to class A:—A. P. Miller (Jan. 22); L. A. Lewis (Jan. 31).

F/O. K. Garston-Jones resigns his commn. (Feb. 1); F/O. N. N. McKinnon, relinquishes his commn. on account of ill-health (Feb. 7); F/O. J. C. Noel relinquishes his commn. on completion of service (Jan. 17).

SPECIAL RESERVE

General Duties Branch

F/O. the Hon. H. C. H. Bathurst is promoted to rank of Fl. Lt. (Jan. 20).

AUXILIARY AIR FORCE

General Duties Branch

No. 600 (City of London) (Bomber) Squadron.—F/O. G. P. Kerr is promoted to the rank of Flight Lt. (Jan. 12).

No. 601 (County of London) (Bomber) Squadron.—F/O. T. L. E. B. Guinness M.P. (Sec. Lt., Irish Guards, R.A.R.O.), is promoted to rank of Flight Lt. (Jan. 14).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Air Commodore L. A. Pattinson, D.S.O., M.C., D.F.C., to Armament Group, Eastchurch, 4.2.34, on appointment as Air Officer Commanding.

Wing Commanders: N. H. Bottomley, A.F.C., to Aircraft Park, India, Lahore, 18.1.34, to Command, vice Wing Com. M. Henderson, D.S.O. M. Thomas, D.F.C., A.F.C., to H.Q., R.A.F., India, New Delhi, 7.1.34, for Air Staff duties, vice Wing Com. A. Gray, M.C.

Squadron Leaders: J. R. Cassidy to No. 19 (F.) Sqdn, Duxford, 8.2.34, to Command, vice Sqd. Ldr. A. C. Sanderson, D.F.C. R. E. G. Fulljames, M.C., to No. 10 (B.) Sqdn., Boscombe Down, 7.2.34, for Flying Duties, vice Wing Com. C. B. Dalison, A.F.C. R. F. S. Leslie, D.S.C., D.F.C., A.F.C., to H.Q., Air Defence of Gt. Britain, Uxbridge, 11.2.34, for Personal Staff duties, vice Sqd. Ldr. W. K. Mercer. W. Underhill, D.S.C., to Air Ministry, Dept. of A.M.P. (D. of T.), 7.2.34, for Air Staff duties, vice Wing Com. I. T. Lloyd.

Flight Lieutenants: J. B. Lynch to No. 29 (F.) Sqdn., North Weald, 5.2.34. G. V. Carey to No. 100 (T.B.) Sqdn., Singapore, 5.1.34. de L. Cooke to No. 39 (B.) Sqdn., Risalpur, India, 11.1.34. A. P. White to Aeroplane and Armament Experimental Estabt., Martlesham Heath, 8.2.34. N. Young to R.A.F. Training Base, Leuchars, 12.2.34.

Flying Officers: E. E. Noddings to Anti-Aircraft Co-operation Flight, Biggin Hill, 1.2.34. G. G. Barrett to R.A.F. Base, Calshot, 28.1.34. R. S. Darbishire to R.A.F. Base, Gosport, 2.2.34. P. E. Hudson to R.A.F. Base, Calshot, 28.1.34. K. W. Niblett to R.A.F. Base, Calshot, 28.1.34. J. A. Powell to R.A.F. Base, Calshot, 28.1.34. A. O. Molesworth to Station H.Q., Andover, 8.2.34. M. D. C. Biggie to No. 10 (B.) Sqdn., Boscombe Down, 10.2.34.

Pilot Officers: E. D. M. Nelson to H.Q., Coastal Area, Lee-on-the-Solent, 8.2.34. P. R. Robinson to No. 823 (F.S.R.) Sqdn., Malta, 3.2.34.

Acting Pilot Officer J. L. Barker to No. 3 Flying Training School, Grantham, 6.2.34, on appointment to a Short Service Commission.

Stores Branch

Squadron Leader P. J. Murphy to No. 22 Group H.Q., S. Farnborough, 5.2.34, for Stores Staff duties, vice Wing Com. N. R. Fuller.

Flight Lieutenant A. H. Allan to Air Armament School, Eastchurch, 5.2.34.

Accountant Branch

Wing Commander J. L. Robertson to H.Q., Air Defence of Gt. Britain, Uxbridge, 12.2.34, for duty as Command Accountant, vice Wing Com. A. G. N. Belfield, O.B.E.

Flight Lieutenant A. C. Lobley to H.Q., Fighting Area, Uxbridge, 10.2.34.

Flying Officer C. V. Mears to No. 503 (C. of Lincoln) (B.) Sqdn., Waddington, 7.2.34.

Medical Branch

Squadron Leaders: D. G. Boddie to R.A.F. Depot, Uxbridge, 1.2.34, for duty as Med. Officer. H. McW. Daniel to R.A.F. Depot, Uxbridge, 1.2.34, for duty as Med. Officer. P. A. Hall to Central Med. Estabt., 8.2.34, for duty as Consultant in Surgery. R. W. White to No. 25 (F.) Sqdn., Hawkinge, 12.2.34, for duty as Med. Officer. P. H. Young to Central Flying School, Wittering, 12.2.34, for duty as Med. Officer.

Flight Lieutenants: J. F. McGovern to Station H.Q., Manston, 1.2.34. C. G. J. Nicolls to Central Med. Estabt., 1.2.34. A. Harvey to Aircraft Park, India, Lahore, 13.1.34.

Flying Officer (now Flight Lieutenant) L. M. Corbet to No. 1 (Indian) Wing Station Kohat,, 15.4.31.

280 Vacancies for Aircraft Apprentices

The Air Ministry announces:—

280 aircraft apprentices, between the ages of 15 and 17 on September 1, will be required by the Royal Air Force for the next entry to the Schools of technical training at Halton, Bucks, and at Cranwell, Lincs. They will be entered partly by competitive examination and partly by "Direct entry" (on presentation of an approved first school certificate). Entry from both sources will take place in August, 1934.

The competitive examination will be conducted at numerous local centres on June 5 next. The sons of officers, warrant officers, and senior N.C.O.'s who are serving or who have served in the Royal Air Force, the Royal Naval Air Service, or the Royal Flying Corps will receive special consideration. Full information regarding the examination, the methods of entry, and the apprenticeship training scheme generally can be obtained upon application to the Secretary, Air Ministry (Aircraft Apprentices Department), Gwydyr House, Whitehall, London, S.W.1. Intending applicants may also apply for information and advice to the headmaster of their school.

Successful candidates will be required to complete a period of 12 years regular Air Force service from the age of 18, in addition to the previous training period. At the age of 30 they return to civil life, but will normally be given an opportunity to enter the R.A.F. Reserve for four years and to draw a gratuity of £100. A proportion, limited by the requirements of the service, may be permitted to re-engage to complete time for pension.

The skilled trades at present open to boys are those of fitter, wireless operator-mechanic, and instrument maker.

During the training period the present rate of pay for successful candidates is 1s. a day for the first two years and 1s. 6d. a day thereafter until the apprentice has both attained the age of 18 and been posted to a unit on completing his apprenticeship training. When he is posted to a unit for duty as an aircraftman the commencing rate of pay at present varies from 3s. 6d. to 5s. 6d. a day (24s. 6d. to 38s. 6d. a week), according to the marks obtained in the passing-out examination. He also receives free board and lodging and an allowance for uniform. Subsequently, there is the prospect of promotion subject to his having passed certain prescribed tests.

A few apprentices of special promise are granted free cadetships at the Royal Air Force College for training for commissioned ranks.

For the remainder opportunities arise later to volunteer to qualify in flying and become airman pilots. About 100 of the latter are selected annually from volunteers of all trades. From amongst airman pilots a few are periodically selected for commissioned rank.

Lighting of High Masts at Rugby Radio Station

The masts of the Rugby Radio Station, situated lat. 52° 22′ N., long. 1° 11′ W., with a maximum height of 1,180 ft. above sea level, constitute an obstruction to air navigation.

The following method of lighting this obstruction will be put into operation on and after February 1, 1934:—

(i) Near the centre of the group of masts, a fixed red Neon beacon on a structure 45 ft. above ground level and visible under normal conditions (85 per cent. transmission) for a distance of 18 miles.

(ii) On the top of the mast at the S.E. corner of the group of masts, at a height of 820 ft. above ground level, a fixed red light visible under normal conditions (85 per cent. transmission) for a distance of 6½ miles.

These lights will be operated by night for a period of three hours from sunset, and by day during periods of poor visibility. No other lights will be shown to delineate the obstruction.

WONDERS OF NATURE VIEWED FROM THE AIR

(Concluded from page 167)

process of erosion from the mountain ranges, produced the rich plains. In South Sicily we see a still later stage where the rocky plateaux (*viz.*, what was the original outer chilled surface of the molten mass) are being rapidly denuded of the remaining soil and "man" struggling to preserve what little remains in the ways described.

In viewing Mount Vesuvius and Mount Etna in action we are undoubtedly seeing an actual process of Nature which must have been very general in many parts of what was eventually to be our world, possibly millions, but certainly many thousands, of years later. In the densely wooded areas south of Rome we can see what extensive areas of the world must have been like some time after the prehistoric monster age, when tropical jungle swamps had decreased and a drier, healthier climate was the rule, more suited to the needs of "man"—God's final act in the creation of the world.

[We are indebted to Imperial Airways for obtaining from the Italian Air Ministry the photographs illustrating this article.—Ed.]

AIRCRAFT COMPANIES' STOCKS AND SHARES

DURING the past month shares of aircraft and allied companies have been one of the most buoyant features of the industrial section of the Stock Exchange, and on balance numerous large rises have been established. In view of reports that various companies are doing active and increasing business, the market is taking the view that there are favourable prospects of larger dividends for the current year and share prices have been adjusted accordingly. In accordance with the general tendency, the disposition is for prices to discount increased earnings and dividends a long way ahead. Despite the further denial of the directors that they are contemplating a share bonus, Rolls-Royce have moved up further, and as compared with a month ago there has been a substantial advance from 77s. to 89s. 6d. This is attributed to the anticipations that owing to the expansion of the aero engine side of the business the forthcoming report may show higher profits and also a larger dividend. For the previous year the dividend of 10 per cent. was very conservative, as about 18½ per cent. could have been paid if profits had been distributed up to the hilt. Hawker Aircraft are 22s. 9d., compared with 19s. 3d. a month ago, the view having grown in the market that a favourable dividend is in prospect for the initial financial period of the public company. The preference shares are also higher at 22s., compared with 21s. 3d. De Havilland were the centre of active business on very favourable trading reports; on the month there has been a rise from 38s. 6d. to 48s. Imperial Airways, which also participated in the upward movement, are 40s., a gain of 1s. 3d. on the month. There was increased interest in Napier issues on the high expectations attaching to the company's new engine and the hope that the directors will be able to refer in the forthcoming annual report or at the meeting to improved prospects for the current year. The dividend on the 7½ per cent. preference shares is paid to date, and as that on the 8 per cent. preference is non-cumulative, the way is open for the resumption of dividend on the ordinary shares as soon as earnings permit of this. Fairey Aviation are 2s. up on the month, as are Handley Page preference. Petters issues were unchanged in the absence of much business to test quotations. In other directions Hoffmann Manufacturing moved up from 28s. 9d. to 31s. 3d. on hopes that the report, due shortly, will confirm expectations of a larger dividend. S. Smith (M.A.) preferred ordinary did not hold the whole of their gain of the previous month, but the deferred were higher, there being expectations that an interim dividend will be paid on the deferred shares this year. Joseph Lucas were well maintained, awaiting the interim dividend announcement, which in this case is due any time now. Brown Brothers were very firm on favourable views regarding the report, which falls to be issued in March, and also on the further acquisition announced by the company recently. Dunlop Rubber have again come for active business, and are several shillings above the price ruling a month ago, there being estimates that the dividend will be raised from 4 per cent. to at least 8 per cent. Vickers were well maintained and Triplex Safety Glass higher at around 84s.

Name	Class	Nominal Amount of Share	Last Annual Dividend	Current Week's Quotation
		%		
Anglo-American Oil	Deb.	Stk.	5½	101
Armstrong-Siddeley Develop.	Cum. Pref.	£1	6½	23/9
Birmingham Aluminium Castg.	Ord.	£1	7½	31/7½
Booth (James), 1915	Ord.	£1	15	69/3
Do. do.	Cum. Pref.	£1	7	28/6
British Aluminium	Ord.	£1	5	31/9
Do. do.	Cum. Pref.	£1	6	24/6
British Celanese	Ord.	10/–	Nil	13/9
British Oxygen	Ord.	£1c	6½	44/7½
Do. do.	Cum. Pref.	£1c	6½	26/10½
British Piston Ring	Ord.	£1	20	72/3
British Thomson-Houston	Cum. Pref.	£1	7	28/1½
Brown Brothers	Ord.	£1	10	48/9
Do. do.	Cum. Pref.	£1	7½	30/–
Dick (W. B.)	Cum. Pref.	£10	5	113/9
De Havilland Aircraft	Ord.	£1	7½	48/–
Dunlop Rubber	Ord.	c	4	45/4½
Do. do.	"C" Cum.Pref.	16/–	10	29/3
En-Tout-Cas (Syston)	Def. Ord.	1/–	Nil	–/7½
Do. do.	Ptg. Ptd. Ord.	5/–	Nil	3/3
Fairey Aviation	Ord.	10/–	10	28/6
Firth (T.) & John Brown	Cum. Pref.	£1	6D	16/–
Do. do.	Cum. Pref.	£1	5*D	16/–
Ford Motor (England)	Ord.	£1	Nil	24/9
Fox (Samuel)	Mt. Deb.	Stk.	5	80½
Goodyear Tyre and Rubber	Deb.	Stk.	6½	104
Handley Page	Ptg. Pref.	8/–	10	15/3
Hawker Aircraft	Ord.	5/–	B	22/9
Do. do.	Red.Cum.Pref.	£1	B	22/–
Hoffmann Manufacturing	Ord.	£1	5	31/3
Do. do.	Cum. Pref.	£1	7½	26/10½
Imperial Airways	Ord.	£1	5	40/–
Kayser, Ellison	Ord.	£5	1	70/–
Do. do.	Cum. Pref.	£5	6	102/6
Lucas (Joseph)	Ord.	£1	25E	59/–
Napier (D.) & Son	Ord.	5/–	Nil	9/–
Do. do.	Cum. Pref.	£1	7½	23/9
Do. do.	Pref.	£1	8A	18/9
Petters	Ord.	£1	Nil	7/6
Do.	Cum. Pref.	£1	7½G	13/9
Roe (A. V.) (Cont. by Armstrong-Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	c	10	89/6
Smith (S.) & Son (M.A.)	Def. Ord.	1/–	25	7/3
Do. do.	Pt.Pfd.Ord.	£1	14	56/6
Do. do.	Cum. Pref.	£1	7½	28/9
Serck Radiators	Ord.	£1	12½	45/–
"Shell" Transport and Trading	Ord.	£1	7½*	53/9
Do. do.	Cum. Pref.	£10	5	£12½
Sternol	Cum.Pfd.Ord.	10/–	4F	6/–
Triplex Safety Glass	Ord.	10/–	25	84/–
Vickers	Ord.	6/6	4	8/10½
Do.	Cum. Pref.	£1	5*	23/6
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—

* Dividend paid, tax free. c £1 unit of stock. D Last xd. March, 1931. A Last xd. September, 1931. B Issued this year. G Last xd. July 19, 1932. E Also 100% share bonus. F Actual: in respect of arrears.

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IMPORTS AND EXPORTS

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910).

For 1910 and 1911 figures see FLIGHT for January 25, 1912.
For 1912 and 1913, see FLIGHT for January 17, 1914.
For 1914, see FLIGHT for January 15, 1915, and so on yearly, the figures for 1933 being given in FLIGHT, January 18, 1934.

	Imports		Exports		Re-exports	
	1933.	1934.	1933.	1934.	1933.	1934.
	£	£	£	£	£	£
Jan. ..	2,073	—	82,963	255,437	827	—

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PUBLICATIONS RECEIVED

L'Année Aéronautique, 1932–1933. By L. Hirschauer and Ch. Dollfus. 14th Year. Dunod, 92, rue Bonaparte, Paris.

Medical Notes and First-Aid Treatment for Flights in the Tropics and Sub-Tropics. Air Publication 1486. London: H.M. Stationery Office, W.C.2. Price 4d. net.

Interludes. Vol. IV, No. 1. January, 1934. Intertype, Ltd., Farnham Road, Slough, Bucks.

The Journal of the Royal Air Force College, Cranwell. Vol. XIV. *No.* 1. *Spring*, 1934. Aldershot: Gale and Polden, Ltd.

Everybody's Book of Aeroplanes. By R. Barnard Way. London: Percival Marshall and Co., Ltd. Price 1s. 6*d.* net.

Calendar, 1934. Syndicato Condor, Ltd., Rua Alfandega, 5-3, Rio de Janeiro.

Bulletin du Service Technique de l'Aéronautique. No. 14. *Limites Thermodynamiques de la Force Motrice aux diverses Altitudes de la Troposphère.* By D. Jacovleff. August, 1933. Librairie Polytechnique Ch. Béranger, Quai de la Grande Bretange, 1, Liége, Belgium.

Brico Piston Ring Catalogue and Directory. The British Piston Ring Co., Ltd., Holbrook Lane, Coventry.

The Phantom Plane. By Capt. A. O. Pollard, V.C., M.C., D.C.M. London: Hutchinson and Co. (Publishers), Ltd. Price 7*s.* 6*d.* net.

Exploring the Upper Atmosphere. By Dorothy Fisk. London: Faber and Faber, Ltd. Price 6*s.* net.

British Legion: Annual Report and Accounts, 1932-33. British Legion, Haig House, 26, Eccleston Square, S.W.1.

Wardle Prismats. The Wardle Engineering Co., Ltd., Old Trafford, anchester.

Aluminium Sections. The British Aluminium Co., Ltd., Adelaide House, King William Street, London, E.C.4.

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PATENT AERONAUTICAL SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = motors (The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

APPLIED FOR IN 1932

Published February 22, 1934

14,243. E. G. BUDD MANUFACTURING CO. Construction of aeroplanes. (404,959.)
20,520. J. MARTIN. Aeroplane wings. (404,963.)
20,798. BRISTOL AEROPLANE CO., LTD., and H. J. POLLARD. Light-metal structures for aeroplane wings. (404,944.)

APPLIED FOR IN 1933

Published February 22, 1934

8,665. FAIREY AVIATION CO., LTD., and M. J. O. LOBELLE. Chassis or undercarriages of aircraft. (405,132.)
35,505. E. G. BUDD MFG. CO., LTD. Boats, pontoons, aeroplanes, etc. (404,952.)